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A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

June 23, 1923

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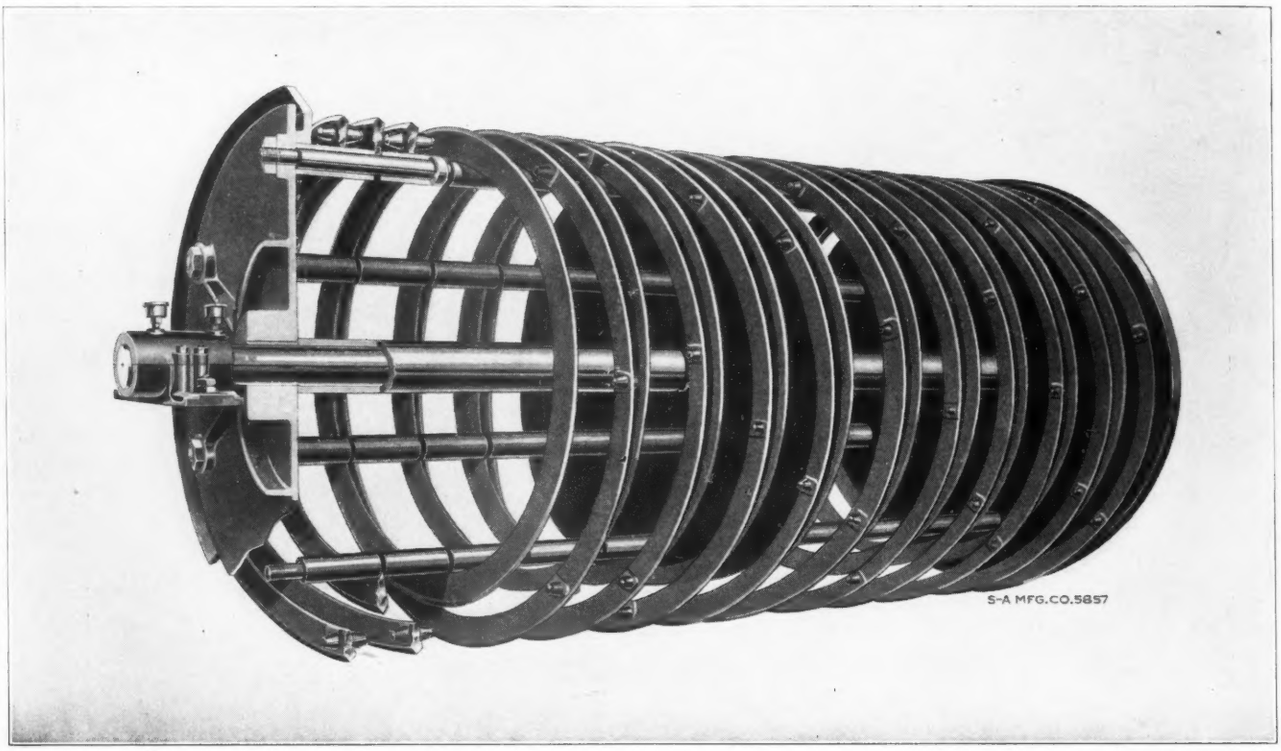

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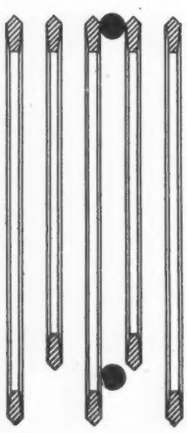

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ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

Volume 115 | New York, June 23, 1923 | *Number* 25

The Men Who Govern Us

SINCE THE WAR there has been a great deal of complaint about the way those who are in control of governments have handled the situations with which they have had to deal. The feeling has been general that the men in charge are not the biggest men in the country, not the men best fitted for the job. The idea is that they are essentially politicians, whereas they should be economists, engineers, or business men. Every movement must have its slogan, so we have come to hear "More business in government and less government in business."

The success of Herbert Hoover as an administrator of public affairs has helped to emphasize the wisdom of calling on other professions than that of the law for positions of public trust. Engineers as a class have been urged to pay more attention to their duties as citizens, but few, so far as we have heard, have yet "gone into politics" even in a minor way. Being mayor of a company town is about as far as they get, and this is not getting anywhere at all.

The idea of having high political offices filled by other than politicians is just now finding an outlet in the proposal that Henry Ford be nominated for President at the next election in November, 1924. No topic is causing more lively discussions in the places where men meet informally and must have something to talk about. There is always a division into two groups—those who are very strong for Mr. Ford and those who think that as President he would be the greatest calamity that the country has ever faced. In all probability, if elected President, he would be neither the worst nor the best man that has filled that position. He would find that any of his ideas that were very radical, no matter how good, would be turned down by the politicians composing the Congress; and the same disposition would be made of any fantastic experiments that he might want to try that would injure the country. In other words, his power for good or evil would be small, and it would be his diplomatic ability that would be put to the test rather than his business acumen. Possibly his greatest opportunity would lie in the selection of men for his Cabinet, and he has shown that he can pick good men.

It is not in picking men for the Presidency that the engineers and business men of the country can work to the best advantage. First, we must have better aldermen; better trained and more intelligent mayors; and for Congressional Representatives and Senators men who are closely in touch with the industrial life of the country and who can speak at least one foreign language. The politicians who now select the candidates are well content with the present system, and something radical will have to be done to change it. We have no suggestions to offer and merely wish to point out that one good man at the top can do little unless he has the power of an autocrat, which is what he usually has when, like Ford, he makes a great success in business.

Metallurgical Losses and Pittman Act Silver

SENATOR PITTMAN has always championed the miner, especially the small producer. He has tried to see that the miner got a square deal in the administration of the Pittman Act. The Senator's latest investigation has to do with the adjustment made with respect to silver lost in the course of smelting the ore. In the early days of custom smelting in the West a deduction of 5 per cent of the silver content of ores purchased by smelting companies was made to cover metallurgical losses in the process of recovering refined bullion. Generally speaking, that practice, as a matter of theory, has been retained. Now, Senator Pittman found that the reports made by the American Smelting & Refining Co., in compliance with the regulations of the Mint, give the net metallurgical loss of silver in all the company's plants, since the beginning of the Pittman Act purchases, as only two-fifths of 1 per cent. Three years ago no mentally sound ore-buying agent (and there is no other kind) could have been third-degreed into admitting to a miner that the smelters got more than 95 per cent of the silver, much less 99⅜ per cent.

The Senator reasoned this way: In spite of certain bookkeeping alterations in ore contracts, the custom smelting companies were paying the producer for 95 per cent of his silver on the assumption that they recovered about that much; and yet the largest vendor, who handled more than half of the silver, sold 99⅜ per cent to the government at the Pittman Act price. The difference between 95 and 99⅜ per cent on 100,000,000 oz. was 4,400,400 oz., and, if this amount had been erroneously accepted by the government, there remained that many ounces still to be replaced after the apparent completion of the purchases. This would be augmented by quantities of similar character involved in the transactions of the other smelting companies. Accordingly, Senator Pittman called the representatives of the principal vendors to Washington. Mr. Kelly, of the Anaconda company, testified that from many ores his company recovered only 95, 90, or even much less of the contained silver, and that he had "urged very strenuously" the continuation of the practice originally adopted by all the smelting companies in May, 1920, of paying for 95 per cent of the silver and selling the same 95 per cent to the government. The reports of his company show a recovery of about 97½ per cent.

Mr. Brownell then explained the position of the A. S. & R. Co. Until January, 1921, his concern settled with both miner and mint on a 95 per cent basis. In the meantime he had learned that a competing smelter had altered its contracts so as to pay ostensibly for 100 per cent of the silver content, although an amount was added to the treatment charge equivalent to the value of the 5 per cent of silver. The miner got no more and no less than he did under the old arrangement. The change was purely a matter of bookkeeping. The A. S.

& R. Co., in common with the other smelters, made the same change early in 1921 and proceeded to sell whatever silver was recovered in excess of 95 per cent at the Pittman Act price instead of at the open-market price, as it had been doing. This was done with the knowledge and approval of the Treasury officials. Mr. Brownell asserted (and in respect to lead, at least, we thoroughly agree with him) that improvements in metallurgy had long ago made the old 5 per cent deduction obsolete; he explained that the practice was retained by custom and that the saving in excess of 95 per cent accrued to the smelting company and permitted it to make the treatment charge less. He declared that his company got most of its silver from lead-smelting operations and that the saving was much better than that obtained by the Anaconda and other companies in treating zinc and copper ores.

Senator Pittman called attention to the fact that the report showed that metallurgical "gains" totaled 3,211,322, as against "losses" of 3,908,043, leaving a net loss of only 696,721 oz. Since no segregation of domestic and foreign ores is made in treatment, it is necessary to divide the total net metallurgical losses proportionately on the basis of the amount of silver contained in the ore. In other words, it is assumed that the recovery on domestic and foreign ores is virtually the same.

It developed that the calculation of the net gains and losses involved estimates by the various plant managers of the quantity of silver on hand at different periods in ore-beds, furnaces, flues, and in various metallurgical byproducts; and it was admitted that these "guesses" might be wide of the mark, as definite bases for calculation were unobtainable. The A. S. & R. policy, said Mr. Brownell, had been to sell at the Pittman Act price the exact quantity, as nearly as could be determined, of silver actually recovered as bullion from ores mined in the United States. This, he says, is about 99⅝ per cent of the silver paid for in the ores purchased. Silver not paid for because the content of the ore is under 1 per cent is regarded as foreign silver and does not affect the apparent recovery.

Senator Pittman urges vigorously that all settlements be refigured on a flat arbitrary metallurgical loss of 5 per cent. He maintains that the burden of proof that any silver, offered for sale at one dollar, qualifies under the terms of the act as to domestic origin, lies with the vendor. It is through sufferance that the mixing of foreign and domestic ores is permitted by Mint officials. He says that a thorough examination of all the smelting company books would entail large expense and lost time; that the result would even then be uncertain and unsatisfactory; that the 95 per cent basis of settlement is economical, simple, quick, practicable, and more nearly equitable than any other. He has convinced Mr. Kelley that his contention is reasonable, and Mr. Kelley has authorized him to say that the Anaconda company stands ready to settle on the basis of the delivery of miners' affidavits for 100 oz. of silver for every 95 oz. that is delivered at the mint.

Although it seems possible that the "estimators" for the A. S. & R. Co. may have erred in the direction of small losses, we do not believe that the smelting companies, in collusion with the government, have, or are about to, put over something that will be a gross injustice to the miner.

Whatever the outcome of the present controversy, the white light of publicity is an excellent thing for everybody concerned.

Pay of Engineers

IT IS A WELL-WORN TRUTH that engineers are underpaid—so worn, indeed, that it is becoming shabby and as a matter of shrewd policy ought to hide itself. Publicity of the fact will not help, but rather tends to weaken the engineer's position in the eyes of his employer. Further, it does not aid the engineer in the community in which he lives. At best he may expect the sympathy of his neighbors, but count himself cheapened if he gets it.

The pay of engineers cannot be raised by talking. It is controlled, like everything else, by the law of supply and demand. The trouble is and for years has been that the supply exceeds the demand. In the face of such a well-known fact, what good will talking do? What remedy for his condition, then, has the engineer who finds his remuneration insufficient for his desires? Two courses present themselves: either he can continue in his profession, resolving by merit to attain the highest prize it has to offer and to take as his deserts what fate may hand him if he fails to reach his goal, or else he may abandon it and take his chance in some new or some related work, according as he thinks he has ability, or as opportunity may present itself. To pursue the latter course is to adopt heroic measures, for the risk of failing in unfamiliar work is great. A dilemma certainly confronts the man who feels called upon to make the choice, but action alone, not talk, will extricate him.

Those who prefer to cling to their professional work will find no royal road to fortune. There never is. But there are big prizes to be attained as well as important positions to be filled as their present incumbents retire. There is opportunity for the man of outstanding merit. But hard work is the portion of those who would achieve it, and time spent in bleating about insufficient remuneration can be counted lost.

Tailings Not Part of a Mine

"THE tailings, severed and removed from the mining claims, changed in character, placed on other and separate lands and having an ascertained and adjudicated value of their own, in our opinion, constituted a unit of property entirely apart from the mine from which they had been taken. . . . We think the agreement with the leasing company was not a sale of these tailings, but that the ownership, pending the process of reduction, remained in plaintiff. The plaintiff, therefore, was subject to taxation upon their value, but not as a mine, since that implies something capable of being mined which this loose and homogeneous deposit obviously was not."

So declares the United States Supreme Court in the case of the South Utah Mines & Smelters vs. Beaver County. The details of the case were outlined in our issue of April 17. Officials in Utah collected a tax based on the net proceeds from the reworking by lessees of the tailings pile in question, several years after operation of the mine at Newhouse, Utah, had been discontinued. The mining company sued to recover the taxes and after losing in the lower courts has finally won.

The case is particularly interesting because the Utah Copper Co. is now engaged in fighting another county in Utah to nullify a tax placed on the huge tailings piles below its concentrators at Garfield, about twenty miles from the Bingham mines. The county contends that the tailings are taxable as "personal" property, separate and apart from the mine; the mining company says that they are part of the mining property.

One might suspect that Justice Sutherland, a former Utahn familiar with conditions there, had this case in mind when he wrote the following paragraph of the opinion:

"How far the state statute defining the net annual proceeds to be considered in measuring the value of a mine, properly includes those derived from dumps and tailings placed and remaining upon the mining claims or connected with a going mine, we do not determine; but we do hold that the proceeds from the tailings in question, under the facts here disclosed, are not included within its terms."

Apparently he draws a distinction between a tailings pile owned by a company operating a "going" mine, and by a company holding an "idle" mine. This should comfort Utah Copper in a degree at least.

The opinion seems to recognize the validity of the "net proceeds" methods of taxing mining property used in a number of other states. The principle is set forth in the following lucid paragraph:

"The state constitution plainly contemplates that all property, irrespective of its character, shall be taxed 'according to its value in money.' The provision with reference to the taxation of metalliferous mines does not mean to depart from this rule, but recognizes that their value cannot be determined in the ordinary way, since the ores which constitute the wealth of such property are hidden in the earth and, as a general thing, disclosure of their extent and character must await extraction. The constitution, therefore, provides, not for disregarding value in the assessment of taxes upon mines, but for arriving at it in a special manner—that is, by a measurement proportioned to the net annual proceeds derived from the property. The value of property bears a relation to the income which it affords. If it be property whose production is uniform and of indefinite duration the capitalization of the net income derived from it at the going rate of interest, in the absence of a more certain method, will furnish a reasonable measure of the value. The life of a mine, however, is limited. The extraction of ores from year to year constitutes a constant drain upon the capital, which, in course of time, will be exhausted. It follows that a given multiple of the net annual proceeds which may be a fair measure of value in the early part of a mine's development, will become excessive as the stage of exhaustion approaches. The constitutional provision, therefore, at best, will produce only approximate equality."

Responsibility of Wealth

A CERTAIN OIL MAN born in modest circumstances has accumulated a fortune within the last few years that is reputed to be around $18,000,000—a gift of nature, it seems to some. Citizen X, hearing the story, commented on the enormous buying power thus placed in the hands of one unaccustomed to wield it. The case may be duplicated many times in this rich land of ours. Fortunes come quickly—and go—with oil. Citizen X, too, has many a counterpart, prone to shake the head, though from motives varying from mild disapproval to Bolshevism.

Great responsibility rests on the wealthy. Often, though the radical will not admit it, this responsibility is well discharged. In itself, to guide a great enterprise to prosperity, affording means of livelihood to thousands and absorbing the bulk of the losses when they occur, is no mean achievement. When to this is added philanthropies of varying scope, much has been done toward discharging the debt to society that the possession of wealth entails. The work of the Rockefeller Foundation, for instance, is notable. Could a saner philanthropy be established? What more enduring monument could be built?

Advice to Advertising Men

ADVERTISING MEN at the recent convention of the Associated Advertising Clubs of the World in Atlantic City were told by the organization's president, L. E. Holland, that the work of protecting the public against fakers in all lines of investment was of fundamental importance. "If you do not want to encourage Bolshevism in America, do all you possibly can to support this movement," said Mr. Holland, "because I cannot imagine anything more likely to turn the average citizen against legal authority so quickly as to lose his money through dealing with fakers who are allowed to be at large owing to the lack of vigorous law enforcement."

Excellent advice! Newspapers and chambers of commerce throughout the country would do well to take it to heart, for they have it peculiarly in their power to spoil many a fraudulent enterprise at the start. In view of this it is unfortunate that the fake promoters whose activities are now being investigated by the government were able to find in many newspapers of the Southwest such ready means for broadcasting their lurid announcements to the public. The responsibility of the press is great and commensurate with its power to expose those who prey upon the unwary, and to frustrate their evil schemes.

A Ruling on War Minerals Relief

BEFORE THERE WAS ANY so-called "stimulation" by the government, urging the need of a greater output of war minerals, some operators had already undertaken various developments, most of them, no doubt, because they saw the chance of fair or handsome profits. It has never seemed proper, therefore, that the government should refund to the operator his total losses in such cases. Obviously, whatever liability the government had resulted only from the operation or that part of the operation that was begun because of its "stimulation." A distinction therefore must be made between stimulation due to federal agencies and any other kind. So thinks the Solicitor of the Interior Department, whose opinion to this effect has just been approved by Secretary Work.

The point is so obvious that it would be surprising that a ruling on it should be necessary, did not one remember the "liberal" tendencies of ex-Secretary Fall. Originally, the commission had carefully made such distinction as to stimulation, and many claims for relief had been thrown out in consequence. Then came the Fall régime and the era of liberalization, during which detailed and exhaustive reports by the government examining engineers on claims were frowned upon and the impression prevailed that the purpose was to distribute as much as possible of the war minerals relief fund so as not to leave any residue of the Congressional appropriation. The Solicitor's ruling is now a step backward in the right direction. Some say that its results will be far-reaching, but this is hard to see: the fat is already in the fire, much water has gone over the dam, or, abandoning metaphors, many claims have already been disposed of, including the notorious Chestatee pyrites case.

Treasuries and funds may sometimes be looted legally when politicians are in control, and when this is done there seems to be no feasible way of putting the money back.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Kick vs. Rittinger

THE EDITOR:

Sir—Mr. Hardinge's comments on my article of March 17 are very interesting and the number of points of agreement is gratifying. It was the long discussion of theories in the case of Rittinger vs. Kick that made us wish for definite information, so we made a list of observed facts and modified the theories in the light of actual tests under conditions not hitherto available.

We have used the same mill as an end-discharge mill and as a peripheral screening mill on the same materials. We have found that a larger unit is nearly always more efficient except on very soft materials, which the weight of the balls alone would crush too fine; for example, salt. A short mill is superior in the end-discharge type. The friction of the ends is as great for a short mill as for a long one, and when using peripheral screening, where only oversize is present throughout the full length of the mill, a much longer unit can be used efficiently. Discharging through the end gave less than half the capacity on an average than when discharging through the screen. There was much more excessively fine material, especially of the soft valuable mineral.

To determine the proper size of balls, we use no theory, but employ an actual testing machine, adjustable for size of balls and height of drop and suitably arranged for collection of the broken material. We observe the drop of balls through the unobstructed trunnion of the running mill and then drop balls of varying sizes from the indicated height on the largest pieces we have to grind.

The screen analysis of the mill product when using the screen discharge corresponds closely with the results indicated by the testing machine. In comparing energy used, the mill itself gives far more output per horsepower than the testing machine indicates, because in the testing machine a large part of the energy is transmitted to the anvil instead of to other balls cushioned with oversize.

In practically all ore-dressing problems conformance to specified mesh is desirable. Uniformity is desirable in every product from jig sizes to slime tables.

There is a difference between grinding thoroughly wet and thoroughly dry materials in an end-discharge mill, because of the easier removal of fines by water. In the peripheral screening mill we found to our surprise this difference disappears. In this mill the fine material is continually removed and it requires more moisture to make any appreciable difference. Stopping the mill in operation shows practically no 200-mesh in the screening mill, and may show over 25 per cent in the inside of an end-discharge mill, where 48 mesh is the desired finished product. The advantage of rapid circulation in an end-discharge mill is to remove some of the fines.

I fully agree with Mr. Hardinge that crushing media should be cushioned to prevent excessive wear, but the cushion should be oversize and not undersize. Obviously, space occupied by undersize is not available at the same time for material that needs grinding.

The consumption of grinding media per day is somewhat greater when grinding only oversize, but the consumption per ton of finished material is markedly less. Liners in the screening mill show uniform wear throughout the entire length.

We at first assumed that the current practice of step reduction was right. We still believe it is right within certain limits in end-discharge mills, but in the screening mill in no instance has an advantage been shown with a smaller step than 14 numbers on the Rittinger scale. For example, 1½ in. to 48 mesh. Conclusions which hold for the end-discharge will not hold for the other, because a big step is really always taking place in an end-discharge mill, and it should be limited. Heavy material always travels to the periphery.

Our own experience tends to show an advantage of impact over attrition in nearly all cases. Even some large portland cement companies are adopting impact speeds for their finishing tube mills.

Those who have never tried reversing the feed and discharge ends of other than cylindrical mills and comparing capacity and screen analysis will find themselves richly rewarded by definite information if they will do so.

JOHN HERMAN.

Los Angeles, Calif.

Chain and Bucket Elevator Device

THE EDITOR:

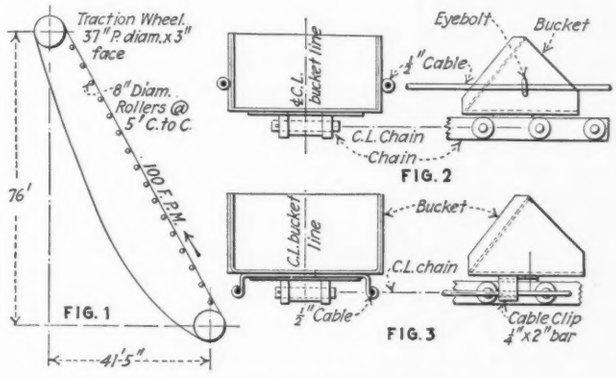
Sir—Referring to the short article entitled "Chain and Bucket Elevator Device" on p. 553 of the *Journal-Press* of Sept. 23, 1922: I do not know the writer and have no idea where he got his information, but what he shows is wrong and what he says is misleading. There was never any need of the device mentioned in the first place, but it was the child of that ignorance and incompetence which flourishes in such places as South America, where good help is scarce in engineering work.

The elevator in question is as shown in Fig. 1 in the accompanying sketch. The original chain was Link Belt No. 847 of malleable iron, 6.075-in. pitch with an ultimate strength of 54,500 lb. The buckets are of $\frac{3}{16}$-in. sheet 12 in. high with 8 in. projection and 16 in. long.

The chain on the carrying side is supported on rollers at 5 ft. intervals and runs on a toothless traction wheel at the top end with a similar wheel at the boot. The speed is 100 ft. per minute, and the load was 75 tons per hour of ore crushed to 4 in.; but later this load was increased to 100 tons per hour, and the size is about 6 in.

The only cause for the breaking of the original chain was that the *cholos* (Indian workmen) running the plant had tried to take up all the slack on the bottom side. When this was stopped the trouble was over, but the device described had been put on before any one arrived on the job who could see what the trouble was.

At present the chain used in Link Belt No. S. L. 847 with 70,000 lb. ultimate strength. It is of the same dimensions as the original, but is of cast steel. This chain has never broken and looks to be good for at least a year more.



Elevator and device used

The original cable scheme had the cable passed through the eye-bolts in the buckets as in Fig. 2, but the slipping of the cable in these eyes as the buckets passed head and tail wheels wore it out quickly. Later the flat iron was put on, not as the writer described, but as shown in Fig. 3.

F. W. COLLINS.

Oroya, Peru.

Freight Rates on Ore and Products

THE EDITOR:

Sir—East of the Mississippi River, transportation has settled to a reasonably stable level, with rates more definitely adjusted to the demands of the traffic, both as affecting the shipper and the transportation companies. West, particularly in the Rocky Mountain states, the old order prevails, and an insistent demand exists for a readjustment of both traffic distribution and rates, throughout the entire mountain section. This demand is marked by the activities of the several associations, representative of various producing industries, wheat growers, stock raisers, mining associations, and, as in the case of Montana, by the action of Attorney General Wellington D. Rankin in initiating the present rate hearing before the State Railroad Commission, on intrastate rates, a function of the state which should be more generally followed, instead of the usual practice of relegating such activities to the too obliging commercial organizations.

Current rates on ores and concentrates are practically the same as since the coming of the railroads; in many instances higher. Rates on bullion and smelter products have been adjusted between the smelting interests and the railroad interests, but without regard to the interest of the shipper of ore or mill product, though it is he who takes all the risk, financially, in supplying the vital element—the ore—on which the smelter must depend, thence the bullion to the railroads.

The appearance of a page of "Freight Rates on Ores and Concentrates" in the *Journal-Press*[1] is most opportune at this time, affording the shipper direct comparison of rates between his camp and the camps of other districts and states and the reduction works. These comparisons disclose the utter lack of fairness in the distribution of transportation costs between the ultimate buyer, the smelter, and the producer of ores. They emphasize the pronounced discrepancy between the rates on ores and the rates on bullion, on the latter regardless of value, regardless of distance transported, regardless of route, regardless of transportation conditions—grades, climate, density of traffic or other variations between transcontinental systems—east-bound.

In making rates on ores the railroads claim as factors for consideration climate, origin on branch or main line, density of traffic, mountainous character of country through which the traffic passes, and other conditions.

The differences in rates effective from the several mining districts to the several smelting centers, also the great latitude employed by the railroads in prorating the "sliding scale" for various values of ore, are other features brought out by the comparisons.

In reviewing these differences, the shipper asks himself if the railroads are losing money by hauling bullion from the Rocky Mountain states to the Atlantic seaboard. He wonders what sort of rule is applied in fixing "Value of Ore" in the schedules; what is the purpose and why do the values vary to such extent as shown, for example, in the rates on ores from Troy, Mont., and Goldfield, Nev., to their respective smelting centers?

Why should the rate on $100 ore for a 500-mile haul equal two-thirds the rate on bullion of $2,000 value for a 2,000-mile haul, with a sliding scale applied to the ore and none to the bullion? In Montana, as in Arizona, the railroads have answered the question on refusal of west-bound rates on ores and bullion, frankly admitting that they want the long haul east, without respect to the shipper's economics or ultimate national economy, for that matter.

By way of pointing out the discrepancies and differences in rates, the following table has been prepared, the cases cited being as nearly analogous as possible with references to general transportation conditions and distances. It sets out, in marked contrast, the utter lack of consideration for the shipper and the close co-operation between the organized smelting and railroad interests, a chaotic condition as affecting the ore producer—to say nothing of the interests of the ultimate consumer—which demands recognition and correction.

The first group of rates is on shipments of large tonnages, in bulk. The iron ores of Lake Superior have a value between $5 and $7 per ton, f.o.b. Lower Lake docks; the Butte ores may vary from a few dollars per ton to several hundred or more. The tonnage from Butte, Mont., compares with that from Ishpeming (the Marquette Range), Mich. The copper company owns the Butte, Anaconda & Pacific; the iron mines the Lake Superior & Ishpeming. From Butte the railroad has the advantage of an all-year haul, whereas the Lake Superior traffic is suspended five or six months of the year, with a heavy investment in dock equipment, motive power, and rolling stock idle during this period and with relatively little other than ore tonnage during the active season, and the Butte line is electrified.

From the annual report of the company for the past

[1]May 5, 1923, p. 824.

year, the following data relative to the B. A. & P. Ry. are taken:

"Operations at Butte were resumed on Jan. 16, gradually increasing during the year. . . . There were mined 1,983,106.07 tons of ore and 7,571.95 tons of precipitates were produced.

"Butte, Anaconda & Pacific Railway Co.—The railway transported 3,411,686 tons of ore and other freight, and 158,527 passengers. The gross revenues were $1,256,622.75; rental and miscellaneous receipts, $36,808.15; operating expenses $1,145,435.24; taxes, interest and rental of leased lines, $244,458.79; net loss, $96,463.13."

Testimony introduced before the Montana Railroad Commission is to the effect that on roads showing an operating income on investment for the year 1922, "the Butte, Anaconda & Pacific, with an investment of $8,540,011, with an operating income of $37,873," was one of the lines of the state operated at an operating profit. These figures are given as showing operating costs on a rate of 17c. and distance of 26 miles. Adding the shipments of ore from Butte mines, other than those of the company, together with shipments of custom ores to the Washoe Sampling Works, Butte, it will be seen that the bulk of the tonnage was ore and concentrate.

Further testimony presented at the hearing in Helena is to the effect that Montana people pay an average of 1.75c. per ton-mile, on all freight—pins, pianos, automobiles, and ore. On bullion, assuming $16.50 as all to the railroads from Montana smelters to St. Paul, the per ton-mile rate is less than 1.5c. Neglecting the Butte-Anaconda rate, the rates on ores from western mines shown in the table about average, on shipping grades, above "the average of 1.75c. per ton-mile," running as high as 2c. to upward of 3c. per ton-mile on "high grade."

Comparative Freight Rates on Ores, Concentrates, and Bullion

Rate on Bullion, per Ton

Idaho, Montana, Colorado, Utah, Nevada and Arizona Smelters to Atlantic Seaboard, $16.50 per ton regardless of value.

Rates on Ores and Concentrates, Per Ton

From	To	Distance, Miles	Value of Ore and Concentrates, Per Ton $10.00	$15.00	$20.00	$25.00	$30.00	$35.00	$40.00	$50.00	$60.00	$70.00	$80.00	$90.00	$100	Over $100
Virginia, Minn.....	Superior, Wis...av.	110	$0.86 maximum.													
Ishpeming, Mich.....	Marquette, Mich.....	15	.54 maximum.													
Butte, Mont.....	Anaconda, Mont.....	26	.17	.17	.17	.17	.17	.17	.17	.17	.17	.17	.17	.17	.17	.17
Rates on Long-Haul Shipments																
Troy, Mont.....	East Helena, Mont...	486	....	3.40	....	3.83	....	4.28	....	4.61	....	....	....	.....	4.84	5.29
Coeur d'Alene, Idaho...	East Helena, Mont...	269	....	....	....	....	3.00	....	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00
Hazen, Nev.....	Salt Lake, Utah.....	540	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	7.40	8.10	8.80	....
Goldfield, Nev.....	Salt Lake, Utah.....	769	....	....	5.10	....	5.80	....	6.50	7.20	7.30	8.60	9.30 (85)	10.00	10.70	....
Maxville, Mont.....	Salt Lake, Utah.....	530	....	....	....	5.96	....	6.30	....	7.09	....	....	8.10	.....	8.40	....
Melrose, Mont.....	Salt Lake, Utah.....	405	3.50	....	4.00	....	4.50	5.00	....	5.50	....	....	....	.....	8.00	....
Rates on Short Haul—Local Shipments																
			Montana													
Maxville, Mont.(a)....	East Helena, Mont...	89	....	....	....	2.14	....	2.36	....	2.70	....	....	....	.....	2.93	3.15
Nimrod, Mont(b).....	East Helena, Mont...	92	....	1.35	....	1.69	....	1.91	....	2.36	....	....	....	.....	2.48	2.70
			Utah													
Eureka, Utah(a).....	Salt Lake, Utah.....	82	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	2.75	3.00	3.25	....
Tintic, Utah(b).....	Salt Lake, Utah.....	96	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	2.75	3.00	3.25	....

(a) On branch. (b) On main line.

The second group of rates in the table disclose the vagaries of rate making on "long hauls" both in interstate and intrastate business. Compare rates between Montana and Idaho points to Montana smelter with rates from Nevada shipping points to Salt Lake smelters. This group also points out the lack of even approximate uniformity in prorating differences in freight rates for varying values of ore, under the "sliding scale."

Just what is the purpose of the "sliding scale"? It would be interesting to know the theory and the basis on which the widely varying steps between the several rates on ores of different values, for a given distance, are figured. Furthermore, it is not apparent to the shipper just why bullion, of perhaps several thousand dollars per ton value, can be shipped at a uniform rate, while the "high grade" is penalized, under existing freight rate practice. The obvious conclusion, to the shipper's mind, is that the ores are taxed "all the traffic will bear." Compared with bullion of any value and for hauls up to five times the distance on which ore rates are based, the rates on ores and concentrates under the second group, especially for values of $100 per ton or over, are, to say the least, unreasonable.

The third group of comparative freight rates, for comparative distances, and as to origin on a branch or the main line—a point given much weight, on occasion, by railroad rate makers—presents an obvious contrast between rates; also the vagaries in the relation of freight rate to valuation of ores. In Montana the rates begin with a higher freight rate on low-value ores, terminating with a lower rate on high-grade ores, as compared with the rates given to Utah smelters.

Comparison of some eighty rates, along the same lines, discloses the same discrepancies, distance, route, and transportation conditions being considered. In some districts no corresponding counter-direction rates are made; in fact, such rates have been refused, or the railroads have procrastinated (indefinitely), openly or tacitly admitting that they do so to force the shipper to favor such smelter or reduction plant as will afford the railroad the long haul on the bullion product. This fact does not lead to the belief that the ore-hauling roads, or connecting lines (the latter not participating in the ore hauling), are losing anything in transporting bullion of high value at $16.50 per ton to the Atlantic seaboard.

It is evident that there is room for a complete revision and reduction of rates on ores and concentrates from producer to smelter, and, furthermore, a readjustment of traffic distribution affording producer as well as smelter the opportunity of shipping east or west as economic conditions and markets justify. The necessity for such reorganization of freight rates and traffic affects the ultimate consumer as well as the miner-producer. There is no doubt that such readjustment, with lowering and equalization of freight rates on ores, and a consequent increase in tonnage and balancing of traffic density, in direction, will redound to the benefit of the transportation companies.

L. S. ROPES.

Helena, Mont.

The Oil of Los Angeles

By T. A. Rickard

THE principal city of southern California is not usually recognized as the centre of an important mining district, yet the production of liquid mineral in the territory adjacent to Los Angeles far exceeds in value the total gold production of California, which is the leading gold-producing state of the Union. In 1922 the output of oil in the Los Angeles area, which includes the counties of Los Angeles and Orange, was 70,718,820 bbl., valued at $96,884,783, this being 50.64 per cent of the total production of oil in California last year. On the other hand, the yield of gold in the state last year was only $14,845,000 and the total production of metals only $21,625,600. The biggest output of gold in California in any one year was $65,000,000, in 1853, this being a third less than the river of wealth that poured into Los Angeles last year, and still less than that which will be produced during the current year. This mining industry was started by three wells that were sunk in 1873 in Pico Canyon, but it assumed no importance until 1894, when the Salt Lake oil field, within the city limits of Los Angeles, produced 196,094 bbl. The city wells are still productive, but they have been eclipsed by the astonishing flow of oil from Long Beach and Santa Fé Springs, both of which started to produce only two years ago. In April of this year Santa Fé Springs was the most productive oil field in California, yielding 6,119,636 bbl. during that month. Long Beach (also known as Signal Hill) was second, with a production of 4,292,847 bbl. The total Californian production in April was 20,695,959 bbl., an increase of 4,269,200 bbl. over that in February. Unfortunately, this lavish outpouring of liquid fuel was more than the market could absorb.

The output of oil in California has risen from an average of 325,000 bbl. per diem in 1921 to an average of 500,000 bbl. per diem in 1922. In April it was 689,865. The total stock of crude oil in the state on Aug. 31, 1922, was 54,300,000 bbl.; this reserve had increased to 61,200,000 bbl. on Dec. 31, 1922, and to 68,937,459 on April 30, 1923. The total increase in stocks during the first four months of this year was 7,752,531 bbl. Naturally, the price of the product declined; thus, oil of 25 deg. Bé. gravity was sold at $1.96 per barrel on July 10, 1920, at $1.46 on Aug. 3, 1921, and at 96c. on July 25, 1922. Since then it has fallen to 74c. on May 15, 1923, which is the lowest price since September, 1916. Two results have ensued: first, the effort to gain a wider market; second, the attempt to store the oil on a larger scale.

Until September last the oil produced in California found a market on the shores of the Pacific, including South America, Australia, and the Orient; since then an outlet has been found through the Panama Canal to the Atlantic Coast. During the week ending on April 21 an average of 225,000 bbl. of Californian oil was received daily at Atlantic and Gulf ports. The cost of storage in steel tanks, formerly of 55,000 bbl. capacity, is estimated at 60c. per barrel. This, of course, is prohibitive except for special purposes; in consequence, large earthen reservoirs are being substituted. The General Petroleum Co. has built several of these of 500,000-bbl. capacity, at a cost of 25c. per barrel, and one of 1,750,000-bbl. capacity at a cost, including piping and fire-walls, of only 21c. per barrel. This huge container has been built near Wilmington, on the coast, about 20 miles from Los Angeles; it is oblong in shape, the width being 680 ft., the length 1,000 ft., and the depth 33 ft. The reservoir consists of an earthen embankment, on a slope of 1:1½, lined with three inches of concrete on the sides and four inches on the floor. The wooden roof, which covers ten acres, is protected with so-called asbestos paper. The Standard Oil Co. is building a similar reservoir, to hold 2,400,000 bbl., at the neighboring refinery of El Segundo. This container will cover nearly twenty acres. Such amplifications of storage are interesting, but obviously they will not go far in alleviating a market condition expressed by a daily output, in California, of 650,000 bbl. per diem. Concerted efforts have been made to curb this excessive production by means of joint action on the part of the operators; it has been suggested that a cut of 30 per cent in the pipe-line runs be accepted uniformly for four months, by which time it is expected that the peak of the output in the Los Angeles area will have been passed. Many wells have been cut down, or "pinched," to the minimum flow compatible with safety, as is indicated by the number of productive wells, which decreased from an average of 9,410 in 1922 to 9,058 in March, 1923.

During the last three months the marketing companies have ceased to take oil in excess of the contracted amounts, but most of the operators are insisting on the observance of their contracts, so that no general reduction is feasible; moreover, the Sherman Act throws its menace over any attempt at a concerted agreement to regulate the output, because such an agreement might be interpreted legally as a conspiracy in restraint of trade. One difficulty in reducing the production arises from the fact that much of it is caused by town-lot drilling in the Los Angeles area. In the Santa Fé district, for example, there are thirty-three wells on twenty acres—that is, a well to each six-tenths of an acre. Seventeen of these are producing. Each lessee is afraid that his neighbor will drain the oil ahead of him.

Probably only the inexorable law of supply and demand will suffice to check the exuberance of production, compelling operators to prevent new wells from "coming in" during the next three months, to restrict the flow from active wells, and to stop fresh drilling for a time, especially of "offset" wells. The Standard Oil Co. has set a good example by shutting down all its wells at Coyote Hills and 54 wells in the Montebello field, both within the Los Angeles area; this company announced on May 4 that it was producing less than 60 per cent of the capacity of its wells. Coyote Hills yielded 7,000.383 bbl. and the Montebello oil field 6,742,042 bbl. in 1922.

Apart from the present exigencies of the oil market, it behooves the people of southern California to conserve their resources in petroleum, and not to squander them in a reckless rush to gain immediate wealth. This counsel of perfection, as it may seem, should fit into even the less far-sighted purposes of the average man, for it appears plain that the present, as well as the future, industrial prosperity of our people, in northern as well as in southern California, is linked with the intelligent use and the moderated production of the limited reserves of liquid fuel.

Anaconda Copper Mining Co.'s Triangulation of the Butte District

How One Mining Area Has Been Provided With a Network of Survey Lines Which Facilitate the Work of Orienting and Map-indexing the Various Properties

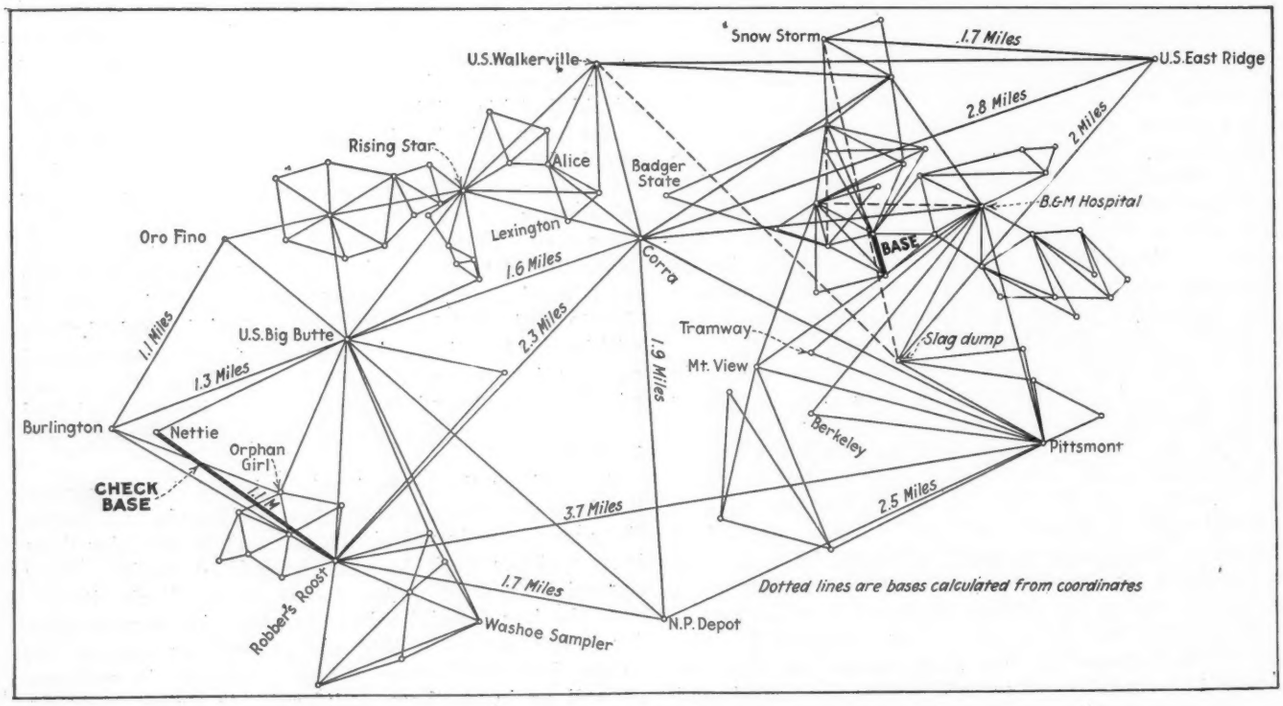
BY J. L. HAYES
Chief Mining Engineer, Anaconda Copper Mining Co.

J. L. Hayes

OF THE MANY branches of engineering, none have greater interest or embrace a larger scope of mathematical skill than those used in the practice of triangulation. It calls into play the basic principles of algebra, geometry, and trigonometry. And by the application of formulas to geometric figures, long distances are accurately computed and co-ordinate positions of prominent points are determined. The triangulation of the Butte district forms the governing basis of all surveys for topographical and mining purposes and lays the network for an extensive map-index.

Triangulation for geodetic purposes needs no word of introduction here. A great amount of credit is due the government for the care and accuracy maintained in its triangulation of the country; and, more especially, for the recent pamphlets which put the figures of geodetic surveys in a practical form for local use. Most of the larger cities now have completed triangulation systems. However, it is seldom that the operations of a single mining company become so extensive as to require a triangulation system to properly co-ordinate the mining claims, surface topography, and underground workings. But with the Anaconda company's numerous properties scattered over a territory the size of a township, an accurate, comprehensive system of surveying is necessary. The triangulation serves this need in the most exacting way that engineering can devise.

Among the old practical foremen, engineers were looked upon with more or less suspicion. As one Cornish foreman said: "Don' need no bloody engineer, you; livel 'em up with me ey!" The early-day surveying was done by engineers engaged in general practice. Few companies employed their own engineers. Each surveyor or mine used a co-ordination scheme of its own. In some instances, engineers who contracted their work with mining companies, connected adjacent properties by surface or underground traverse and calculated all with the same system of co-ordinates. There was



Anaconda Copper Mining Co.'s triangulation of Butte, 1905-1923

little encouragement in this, however, for litigation over orebodies generally made it more profitable to keep maps under lock and key. Nothing less than a manager's signature or an order from the court could obtain permission to inspect mine maps or make an underground survey. Claim lines furnished the only means of orientation. As a group of a dozen or more claims were often plotted from "proportioned" patent-notes, and the underground survey figured from the nearest extant corner, a large number of errors were perpetuated, and no connection could safely be made without running an independent survey to the respective working faces. A tangle of unrelated co-ordinate systems and maps resulted.

Beginning with the Amalgamated Copper Co., in 1904 and 1905, there has been a constant tendency toward consolidation. It required no great urging to enroll the smaller companies as the subsidiaries of larger holding corporations. These mergers brought about a material increase in mining efficiency and greatly reduced the burden and expense of mining lawsuits. The Anaconda company represents the outcome of a steady succession of these mining combines.

To correct and unify the surveys of all adjoining and isolated properties became the work of triangulation. An idea of the size of this task may be had from the fact that there are twenty-seven mine shafts, with full equipment for active production, in the district. Besides these, nearly as many abandoned shafts have extensive underground workings. If all the ground extracted in the Anaconda company's mines during the year 1918 were reduced to a tunnel the size of an ordinary stope drift, it would stretch out for a length of 143 miles. Assuming a safe average extraction for the last thirty years at the rate of 65 miles per year, there are about 2,000 miles of underground workings.

An aerial view of Big Butte, showing Montana State School of Mines "M."

The eight-inch pipe at the summit can be seen for many miles. The Butte stands in the center of an igneous formation which is barren of all mineralization, and it is not likely that ground movement due to mining will ever effect its co-ordinate position.

Early Beginnings—the Base Line

An accurate base line is the first essential of triangulation. With the addition of each triangle built up from the base line, small errors accumulate; and even with the most carefully outlined program for the distribution of errors within the triangle these cannot be entirely eliminated. One fact, however, is apparent: the calculated length of any triangle-side cannot exceed the accuracy of the base line.

In the summer of 1905, the chief engineer (at that time, of the Boston & Montana Co.) and a number of his assistants laid off the base line which has been used throughout the A. C. M. system. As shown in the sketch of the triangulation, it is located along the railroad track midway between Meaderville and the Transcontinental Divide. The tapes were supported the entire length, so that no correction for sag was necessary. According to figures received from the Lufkin Rule Co., a 100-ft. steel tape of that company's make gives a U. S. standard measurement when supported the entire length at a temperature of 62 deg., and using a tension of 11 lb. For practical purposes a temperature correction of 0.0063 per 100 ft. for each 10 deg. variation gives an easy constant for computation and one that the eye readily pictures on the ordinary graduations of a 100-ft. tape. A base line of 1,200-ft. was measured and corrected from these data. Several different tapes were used. The entire distance was measured seven times and the mean average corrected to give a U. S. standard measurement. The difference between the average and any single determination did not exceed a quarter of an inch, and it is probable that this represents the maximum error. In the same proportion the base line would have an error of 1 ft. in 60,000 ft.

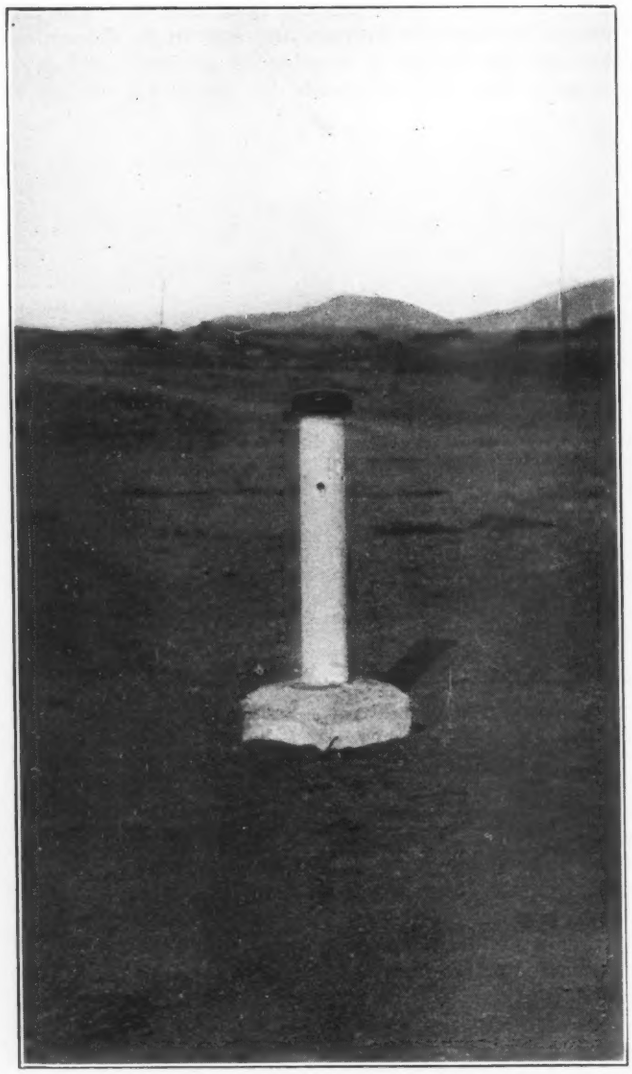
By comparison with U. S. Geodetic Survey base-line measurements, this would be a low grade of accuracy. Along a government base line of five miles, the estimated error does not exceed the almost unbelievable figure of 1 ft. in 3,000,000 ft. But when it is remembered that Geodetic triangles are calculated for hundreds of miles from the measurements of a single base, whereas the net distance covered in the A. C. M. triangulation is about 5½ miles, the comparison is not unfavorable. And, as will be shown, this accuracy is more than adequate for any possible need.

Expansion for Base

Triangulation which has a definite objective, with all possible primary and secondary points included, makes provision for a program of expansion in which the errors are nearly compensating. But such good fortune is complicated by innumerable unforeseens. Stations are often destroyed. At any time a new station may be established to check the tail-end of a meandering traverse. Points which are separated by short distances, as they appear on the map, may span the steep slopes of a gulch or jump up to a bluff along an incline distance twice that of the horizontal. At first glance a number of stations seem to overcrowd their neighbors.

In such cases, special topographical conditions prevail; for it is distinctly the purpose of the triangulation to measure distances with greater accuracy than could be attained with tape and traverse—unadjusted for temperature, pull and other factors. A triangulation which deteriorates to the degree of being less accurate than measured traverse distances is worthless. It must, beyond question, be the governing body of all angular and linear measurements within its boundaries.

The triangulation, as it stands today, is the result of eighteen years of periodical expansion. Could all its needs have been forecast, a more precise method of enlargement would have been followed; but it is doubtful if any appreciable increase in accuracy would result by an entire recheck from the base line. The present boundaries of the triangulation include all the ore-bearing formations of the Butte district, and it is not likely that mining operations will ever call for an extension of the system.



The Orphan Girl, a standard triangulation pipe with concrete base.

The survey number, station name, date of establishment, and elevation are stamped on the cap of the pipe.

The more geometrical conditions included in the work of expansion the greater the accuracy attained. This relationship is termed "strength of figure." The shape of the figure is also an important factor, for it is apparent that an equilateral triangle whose base is known may give an exact estimate of the remaining two sides with little increase of proportional error. But if from a base of 1,000 ft. another triangle whose legs are 10,000 ft. is to be estimated, the geometrical conditions of both triangles will be equal; but the latter is a much weaker figure, because the accurate determination of the two longer legs depends almost entirely upon the exact measurement of the small angle opposite the small known base. Therefore, equal geometrical conditions do not insure equal rates of accuracy. The strength of figure is the relationship between the shape of a triangle, or system of triangles, and the number of geometrical conditions. Of these the most common are: that the sum of the interior angles of a triangle equal 180 deg.; that the interior angles of a polygon equal n-2 $\times$ 180 deg.; that the sum of the angles around the center of a polygon equal 360 deg.

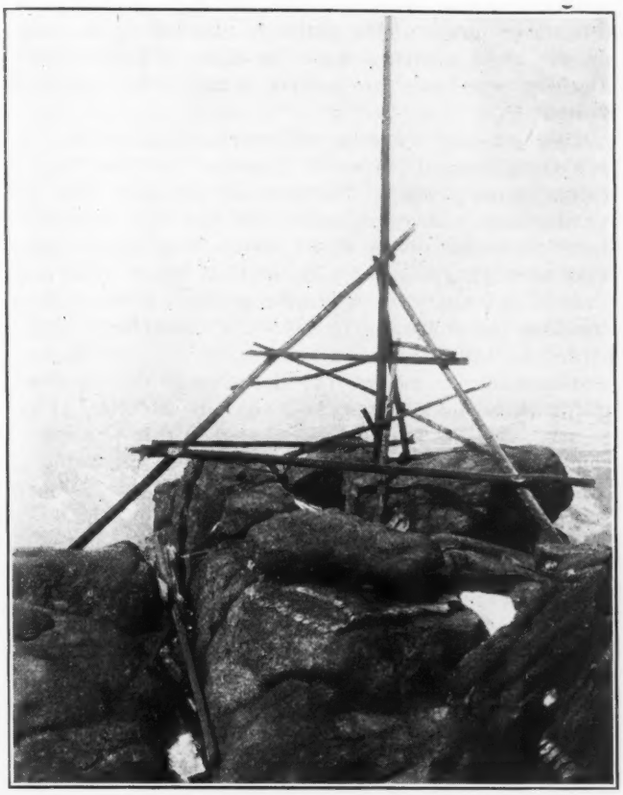
There is no set rule by which strength of figure can be determined. In general, the best results are obtained by keeping the angles as near 60 deg. as possible. The distribution of error is then proportional and it is necessary to determine all three angles with the same degree of precision. An exception to this occurs in problems involving a reduction of base. With a known side of 10,000 ft. a tangent line of 1,000 ft. can be estimated with little decrease of accuracy.

Triangulation Figures

There are three common figures of triangulation: (1) The simple chain-series of equilateral triangles; (2) the hexagon composed of six equilateral triangles, and (3) the quadrilateral, or four-cornered rectangular figure in which six connecting lines inclose four intersecting triangles. Use was made of all three. From the base line two quadrilaterals run in a northerly direction. They have the greatest strength of figure, but are not adapted to rapid expansion in mountainous regions where any three points must be visible from the remaining point. When maximum precision is required, no triangulation figure surpasses the quadrilateral. The length of any exterior side being known, the other three sides may be computed by different triangles so that check estimates of each are obtained. Expansion by this method was slow and difficult. So a simple chain series of equilateral triangles was used in extending the system eastward to the B. & M. Hospital station and northward to Snowstorm. From here larger triangles were resorted to. The two large central-point figures, Corra and Big Butte, furnished excellent conditions for swinging around to Walkerville, N. P. Depot, and the old silver camp, Burlington, about three miles west of Butte. For all-around purposes, the central-point figure, composed of about six triangles, cannot be surpassed. It is easily and rapidly expanded; it has a strength of figure nearly equal to that of the quadrilateral, but covers twice as much area for the same amount of work; it makes a splendid reference point for innumerable tie-bearings. Both Corra and Big Butte occupy prominent topographical positions and can be seen for many miles in any direction.

Mathematical Procedure and Accuracy

The regular development of a triangulation is accomplished through the solution of oblique triangles and the law of sines. In special cases, however, a wide variety of trignometric formulas are important. For these, a thorough knowledge of geometry and trigo-



U. S. East Ridge, a primary triangulation tripod on the tip of the Continental Divide, two thousand feet above the City of Butte

From here, the prominent mountain peaks fifty miles or more away are clearly visible. The reduction of triangulation angles at stations of this kind requires an eccentric point for the set-up.

nometry are absolutely essential. To mention one example: given the length of three sides of a triangle, calculate the respective angles of the triangle without using right triangles derived from the co-ordinates. This involves the extraction of square root of a negative logarithm-characteristic. It is surprising how many surveyors will flounder over this problem.

All angles are averaged and computed to single seconds. Vega, seven-place logarithmic tables are used for computations. As the co-ordinates are figured to the nearest one-hundredth of a foot, mental interpolations are frequently necessary. But let it be said here that there is no better training for the engineer than mastery of a logarithmic table together with the ability to make quick mental interpolations. It is the only table that is capable of solving any problem which surveying may bring forth.

On the other hand, boasting of accuracy is the first blunder which besets the young engineer. Some older ones are also given to the habit of throwing bouquets in a reflective direction. Now, although it is true that accuracy is the chief need of engineering, there is this special amendment: it must be consistent with requirements. Experience teaches the proper gradations.

The triangles used in working northward and eastward from the base line are fairly uniform in size. All angular errors were carefully adjusted. By this method a large number of stations were established around the Meaderville district where mining is intensive. Local traverses were tied in and adjusted to the triangulation points. And from the extreme limits longer calculated bases, determined by right triangles and co-ordinates, were used to swing eastward to East Ridge and westward to Corra, Big Butte, and Burlington. To check the sum-and-total expansion from base, the course from Robbers Roost to Nettie was measured direct. The many slope measurements were reduced to a total horizontal distance, and with proper allowance for temperature and pull, the measured distance checked the triangulated distance within 9½ in. However, the check measurement was made in December with the thermometer near zero, so that correction for temperature was necessarily high. It is not improbable that a measurement made at a more normal temperature would still further reduce the error. The direct distance from the base line to the Nettie amounts to about 4 miles. But this is hardly a fair way of comparing error. The actual zigzag distance traversed from the base line through all the triangles used in the final estimation of the distance from Robbers Roost to Nettie is about 7½ miles. And as the central-point figures are not adjusted by individual triangles, but through the distribution of error to satisfy the geometrical conditions of the entire figure, the difference of 9½ inches represents the total error of about 25 square miles of triangulation.

Special Problems

Owing to its prominence, East Ridge, a primary triangulation point of the Government Survey, was coordinated with great care. An average position was determined from angles turned in three different triangles: Walkerville, Corra, and East Ridge; Walkerville, Slag Dump, and East Ridge; and Snowstorm, Slag Dump, and East Ridge. The mean of these did not vary from any single estimate by more than 4 in. Since the bases from Slag Dump to Snowstorm and Walkerville

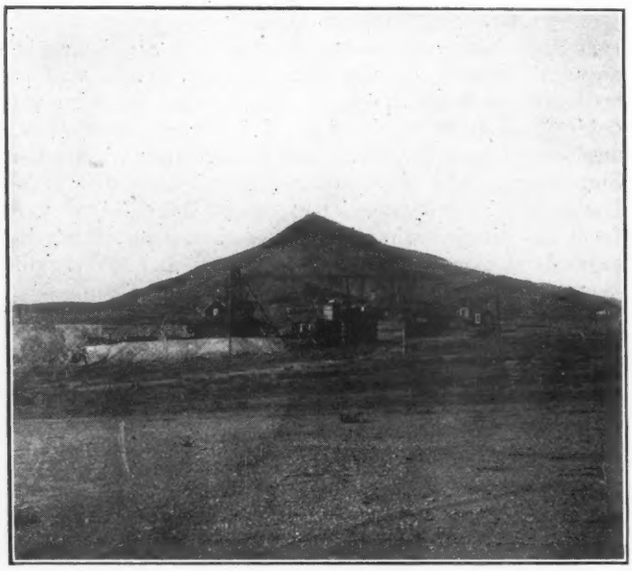
A set-up on Big Butte.

This promontory rises about a thousand feet above the southern portion of Butte. It makes an excellent observation post.

were calculated from co-ordinates, this 4 in. is again a check on the entire work of expansion.

Turning from thoughts of accuracy to those of mathematical interest, the triangulation at Big Butte furnishes splendid material. The original station was a 2-in. drill hole in a rock in place at the summit of the Butte. This became the center of a septangular system of triangles. Later, it was decided to re-establish the former U. S. Geological Survey triangulation point, a granite monument which had been destroyed by fires, the base alone remaining. These two points—the A. C. M. and the U. S. Geological Survey—were only 12 ft. apart. Whereas the A. C. M. had been tied in to the principal government stations and valuable checks derived therefrom, endless confusion seemed certain to result by allowing both points to remain. Permission was obtained from the Director of the Geological Survey to re-establish the government monument. From the A. C. M. point the co-ordinates of the new monument were computed. This furnished data for estimating bearings and distances to all outlying stations.

Where a center and an eccentric point are only separated by a short distance, the only accuracy involved is that of the logarithmic table. The use of an eccentric



The Orphan Girl mine, with Big Butte in the distance.

An illustration of the practical use of triangulation. It is separated from the Meaderville mine by about four miles, but azimuth and co-ordinates are in proper correlation to each other. The establishment of the triangulation station from which these data are derived required less than half a day.

station is often resorted to where a central-point figure of triangles has been built up around a tree or other prominent landmark. In the 360-deg. check at the center a valuable adjustment is obtained, for it is dangerous practice to figure the third angle of a triangle by subtracting the sum of the other two from 180 deg.

Big and Little Transits

The transit is a subject on which many pet and petty theories have been advanced. Among these is the delusion of the "big" transit. In a more general way this feeling is shown in the common belief that "big work" requires "big" machinery; whereas the teachings of experience point out that a big task is no more than the sum of a large number of little tasks, and it is without reason to believe that big feet indicate a big heart any more than all big men use big words. A former executive of the company summed up the matter in one terse sentence when he said: "The ability of the engineer bears an inverse ratio to the size of his transit."

Disregarding a number of intermediate models, there are three typical forms of transits: the four-inch reconnaissance transit, the five- or six-inch type with graduations to even minutes, and the eight-inch direction instrument giving direct readings to single seconds. Special work gives need for each of these. But selection of a transit for mining-engineering work should consider the following points: (1) Simplicity of construction, (2) weight, (3) quality of material used and workmanship of maker, (4) the average degree of precision to be maintained, and (5), the relation of cost to use. When it is remembered that in this—or other—company the time expended in triangulation would not probably exceed one-hundredth of that used in routine surveying, a precise but heavy, intricate, and costly transit is a useless investment. This does not mean that a scrubby little minute-machine will do the work of a direction instrument, any more than that a flivver will do the work of a moving van. However, with care, a really surprising amount of accuracy can be had from the ordinary minute-reading machine.

A half dozen different transits, including one which was made to order, have been employed in the expansion of the triangulation. The intermediate models graduated to 30, 20, and 10 sec. gave evidence that the slight additional accuracy did not justify their increased size and weight. From beginning to end the work was done with the simple minute-reading transit. An average of all instruments used would be represented by one of 5½- or 6-in. horizontal limb, a telescope of about twenty diameters with an inverting lens, four-screw leveling plate, and the usual pair of level vials set at right angles to each other. None of the transits had striding levels.

Instrumental Program

In order to make all instrumental error compensating, as nearly possible, a careful angular program is followed. The angles are repeated six times and the sixth angle is read and approximated to the nearest 30 sec. Two sets of six each are taken: one, reading from the 0 at the A vernier; the other, from 180 deg. as the initial point at the A vernier. No use is made of the B vernier. The average of the two eliminates eccentricity, gives each set of readings on a different portion of the plate, and allows ample play for the keenness of the individual eye to be reflected in the centering of the vertical wire on foresight and backsight. The latter is most important; and, in truth, if any one factor lends accuracy to the "repeating" program, it is that of good, clear vision. A normal eye can set the vertical wire on a fine sight with an error of from 2 to 4 sec.; or, as expressed in a tangent of a hundred feet, an error of from 0.001 to 0.002 ft. Thus, in determining the three angles of any triangle, this accuracy is used no less than seventy-two times, allowing adequate opportunity for the laws of chance to balance the small resulting error. In a like manner, the initial and final readings of each set give a total of twelve vernier values which can effect the mean average in the three angles of the triangle. This error is also nearly compensating, for the eye is as liable to over-read as to under-read.

The figures of the triangulation survey seem to bear out a conclusion that *under favorable weather condi-*

tions, all errors, personal and instrumental, are nearly compensating save those of the vertical axis. In the six sets of six angles each, three are taken with the telescope in a normal position, and three with the telescope in a reversed position. As is well known, this program balances all common instrumental error, except that of the vertical axis. If the vertical axis revolves about any other line than a vertical line, the recorded angle must be smaller than the true angle. Out of forty-six triangles chosen indiscriminately, the average error of closure per triangle amounted to 8 sec. *More than two-thirds* of the triangles closed *under* 180 deg. Wind and weather conditions will account for the excess above 180 deg.

SUMMARY OF USES

The triangulation is the basis for thousands of recent and former surveys. From it their measurements and angular values are adjusted. A uniform system of co-ordinates is maintained. As represented in a single underground working face, about 2,000 miles of mapping is properly oriented. Ground movement, which is a source of constant worry to the engineer, is readily checked from the outlying stations. As new properties are opened up, azimuth and co-ordinates are easily brought to the shaft mouth. If necessary, two crews—one to carry forward the work of triangulation, the other to drop wires and take off from an underground station—in four hours' time could complete all the preliminaries to make an underground connection of four or five miles to any of the company's other properties. The triangulation furnishes an exact method of map-indexing which would be almost impossible otherwise. This makes provision for 10,000 sectional maps, each with its respective block numbers, and all within the same co-ordinate system.

Aside from the Anaconda company, there are four other large mining companies whose engineers are calculating surveys derived from the triangulation. Including these, about 100,000 survey stations are recorded in the proper relation to each other. It is not improbable that the triangulation will continue its present offices for fifty years or more.

Gold Near Brisbane, in Australia

For fifty years the ranges lying at the back of Brisbane, Australia, within a distance of 10 or 12 miles, have been prospected for gold. The gold has been found in several places, and a good deal of money has been spent from time to time in testing the deposits, but hitherto nothing rich enough to be remunerative had been discovered. Last year, however, some auriferous finds were made in these ranges, at a farming center named Brookfield, which give indications of better results than had yet been attained. Twelve claims in this neighborhood have been examined by a government geologist, who says that the reefs on three of these have been proved to be payable. Several tons of ore sent away for treatment have given good returns, and assays of some of the samples taken by the geologist have shown very high results. On the best claim a 2-in. vein of pyrite assayed up to 51 oz. of gold per ton, while the average of the reef, which is 8 in. thick, was 20 oz. to the ton.

The geologist advises an expenditure sufficient to prove the three reefs that have given the best prospects. A company is to be formed to give effect to this recommendation, and one of the first objects of this company will be to define the extent of the rich vein mentioned.

The formation at Brookfield has been declared by the prospectors and some others to be the same as that at Gympie, which for many years was a productive gold field, but on this point the geologists disagree with them, asserting that the Brisbane schists series, which exist at Brookfield, are several millions of years older than the Gympie formation. They assert, however, that, owing to the great antiquity of the Brisbane schists and to the strata being frequently folded, having also been intruded by granite, and felsite dikes, there is no reason why payable reefs should not be ultimately found in the Brisbane region. The red soils in the vicinity suggests that the schists from which they have been derived were originally basic, and would form good precipitants of gold brought up in solution with the reefs.

The Pick-and-Shovel Man Decides To Go to College

Henry S. Pritchett, formerly president of the Massachusetts Institute of Technology, speaking in the annual report of the Carnegie Corporation, of which he is the acting president, says:

"We have today an army of youth pressing into the colleges, so great that the colleges cannot deal with them efficiently. Many of these young men and young women would find their greatest usefulness and their greatest happiness in other vocations than those to be sought through college attendance, and there is more need today to make clear what these opportunities are and to whom they are especially fitting, than to urge upon all the youth of the country the advantage of college attendance."

Too much pressure to go to college, too many men struggling into the professions and into lines of business which seem fitting for the college graduate to enter. Too many who are striving for the black coats of law or medicine. Too many white-collar men.

So it would seem, says *The Nation's Business*, if we read Mr. Pritchett fairly, but where have we been hearing that there are too many retailers, too many grocery-store keepers, too many dealers in shoes? We know, of course, that there are too many wholesalers, too many middlemen. We have long been told that even one middleman is too many.

In fact, there are too many of us all except the pick-and-shovel man. Him the United States cries out for.

But also—and alas!—no one wants to be a pick-and-shovel man. Who would act as chauffeur of a wheelbarrow when he could drive a ten-ton truck? And who would drive a ten-ton truck if he could boss a gang of men?

The son of today's pick-and-shovel man is the engineer of tomorrow. And if the man of the day after tomorrow, the engineer's son, is neither engineer nor engineer's equal, he at least does not go back to the pick and shovel.

No one wants to be at the bottom, strange as it may seem; and if we import muscle today, it tries to be brain tomorrow.

Perhaps a better-arranged world will get along without pick-and-shovel men. It needs no long memory to see the building excavation of our youth, when a swarm of men with shovel filled a truck with dirt and straining horses dragged it up the rattling board incline.

Now a steam shovel guided by one intelligence drops in one operation a load into a gas-driven car that another single intelligence directs. And the job is done in a fraction of time at a fraction of the cost.

A Geologic Time Scale

A Classification Which Uses Numerals as an Aid in Designating the Various Group Formations—Some Modification of Existing Nomenclature Necessary

By George H. Ashley
State Geologist of Pennsylvania

A GEOLOGIC TIME SCALE is based on the order and fossil content of beds of sandstone, shale, and limestone which were originally laid down as sand, mud, or limy deposits in the sea. Earth movements have lifted and locally folded these rocks while erosion has cut into or planed off and exposed the edges, allowing the study of beds several miles thick.

Remains of organisms then living in the sea were buried with the sediments and form a record of life at that time. This life was horizontally widespread, but changed rapidly with time, so the fossils make it possible to determine what rocks were laid down simultaneously.

Owing to the rapid change in life forms and the slow accumulation of the rocks, it is now possible to distinguish several hundred life zones. For example, in 1839, certain rocks in the Jura Mountains of Switzerland, called the Jurassic system, were divided into three groups, as black, brown, and white. In 1858 the same rocks were divided on fossil evidence into eighteen zones, later increased to forty, which may ultimately be divided into a hundred zones. These very thin life zones are frequently delimited by the presence of one or more of the then existing dominant species of animals or plants.

Study of the fossils and rock relations seemed to indicate long periods during which no rocks were laid down. During these "lost intervals," generally representing periods of widespread uplift, life forms changed so as to be entirely different after than before the break in sedimentation. These great breaks formed convenient lines for dividing all the rocks into ten great "systems," named from a locality or some surface feature where first described or from some other circumstances, as follows: 1, Cambrian; 2, Lower Silurian; 3, Upper Silurian; 4, Devonian; 5, Carboniferous, 6, Triassic; 7, Jurassic; 8, Cretaceous; 9, Tertiary; 10, Quaternary.

ERAS	SUBERAS	AGES—SYSTEMS	PERIODS—SERIES	EPOCHS—GROUPS
CENOZOIC (Recent Life) Era of Mammals Maximum thicknesses, 40,000 ft. Estimated duration, 61,000,000 years	LATE CENOZOIC QUATERNARY	O. QUATERNARY Age of ice and man 1,000,000 years	LOWER or PLEISTOCENE	100 Recent 99 Glacial
	EARLY CENOZOIC or TERTIARY Maximum thickness, 40,000 ft. Average thickness, 7,000 ft. 60,000,000 years	N. NEOGENE Average thickness, 35,000 ft. Duration, 30,000,000 years	UPPER or PLIOCENE Maximum thickness, 5,000 ft., in California	98 Merced, Calif. (1894) 97 Purissima, Calif.
			LOWER or MIOCENE (1833) Maximum thickness, 1,400 ft., in Nevada	96 San Pablo, Calif. (1898) 95 Santa Margarita, Calif. 94 Monterey, Calif. (1856) 93 Vacquero, Calif.
		M. EOGENE Average thickness, 3,000 ft. Duration, 30,000,000 years	UPPER or OLIGOCENE Maximum thickness, 12,000 ft., in Italy	92 Chattahoochie, Ga. (1891) 91 Vicksburg, Miss. (1840)
			LOWER or EOCENE (1833) Maximum thickness, 10,000-20,000 ft., in Washington	90 Jackson, Miss. (1850) 89 Claiborne, Miss. (1897) 88 Wilcox, Ala. 87 Midway, Ala. (1887)
MESOZOIC (Middle Life) Era of Reptiles Maximum thickness of rock, 100,000 ft. (Average 15,000 ft.). Estimated duration, 150,000,000 years	LATE MESOZOIC or CRETACEOUS (1822) Maximum thickness, 50,000 ft. Average thickness, 8,000 ft. 75,000,000 years Culmination of reptiles	L. CORDILLERAN (New) Maximum thickness, 24,000 ft., in Montana Average thickness, 3,000 ft. Duration, 35,000,000 years	UPPER or MONTANA (1888) (including Laramie)	86 Laramie, Wyo. (1877) 85 Bearpaw, Mont. (1905) 84 Judith River, Mont. (1811) 83 Claggett, Mont. (1905) 82 Eagle, Mont. (1899)
			LOWER or COLORADO (1877) (including Dakota)	81 Niabrara (1861) 80 Benton, Mont. (1861) 79 Bear River, Wyo. (1874) 78 Dakota (1862)
		K. COMANCHIAN (1887) Maximum thickness, 26,000 ft., in California Average thickness, 5,000 ft. Duration, 40,000,000 years	UPPER or WASHITA (1857)	77 Buda, Tex. (1900) 76 Del Rio, Tex. (1898) 75 Georgetown, Tex. (1900)
			MIDDLE or FREDERICKSBURG (1843)	74 Edwards, Tex. (1898) 73 Comanche Peak, Tex. (1857) 72 Walnut, Tex. (1891)
			LOWER or TRINITY (1888)	71 Paluxy, Tex. (1891) 70 Glen Rose, Tex. (1891) 69 Travis Peak, Tex. (1890)
	EARLY MESOZOIC or JURA-TRIAS Maximum thickness, 40,000 ft. Average thickness, 5,000 ft. 80,000,000 years Increase of reptiles—Evolution of mammals and birds	J. JURASSIC (1795) Maximum thickness, 18,000 ft., in California Average thickness, 2,000 ft. Duration, 40,000,000 years	UPPER	68 Upper 67 Middle 66 Lower
			MIDDLE	65 Upper 64 Middle 63 Lower
			LOWER	62 Upper 61 Middle 60 Lower
		I. TRIASSIC (1834) Maximum thickness, 30,000 ft., in Pennsylvania Average thickness, 3,000 ft. Duration, 40,000,000 years	UPPER or HOSSELKUS (California, 1892)	59 Upper 58 Middle 57 Lower
			MIDDLE or PITT (California, 1894)	56 Upper 55 Middle 54 Lower
			LOWER or INYO (California, 1885)	53 Upper 52 Middle 51 Lower
		H. PERMIAN (1841) Maximum thickness, 12,000 ft. Average thickness, 3,000 ft. Duration, 30,000,000 years	UPPER	50 Upper 49 Lower

The Geological Gaps Filled

Study of other areas eventually disclosed other rocks

3, Upper Silurian; 4, Devonian; 5, Carboniferous, 6, Triassic; 7, Jurassic; 8, Cretaceous; 9, Tertiary; 10, Quaternary.

The Geological Gaps Filled

Study of other areas eventually disclosed other rocks laid down during the "lost intervals" of the earlier geologists, until now the great "breaks" dividing the systems are nearly or quite filled. By piecing together fossil evidence from various localities, a nearly complete story of the development of life can be told, or a complete column of rocks devised.

Closing the gaps in the records by transitional beds and life forms has made difficult drawing the line between the great systems. Broader knowledge has also revealed other major earth movements than those first known and has led many geologists to subdivide some of the larger systems so that all of the systems shall be of more nearly equal length. Furthermore, some geologists believe that these great earth movements used as time markers were rhythmic. This idea, though not widely accepted, has served as a basis for the increase in the number of systems. Certain of these subdivisions have long been recognized in this country, although not always accorded the rank of a system. Believing that their recognition as "systems" is only a matter of time, they are so designated in the accompanying time scale.

Barrell Method of Estimates

A few years ago the late Professor Barrell, of Yale, made a comprehensive review of all the estimates of geologic time, including the results of the studies of radioactive minerals. He concluded that from the beginning of Cambrian time to the present was about 600 million years. Each system in the table represents from 30 to 50 million years. The figures given on the table are an average of Professor Barrell's estimates. They may be too short or much too long. The estimate for each system takes account of many factors, including, first, the area, the average and maximum thickness of rocks laid down; second, lithologic character of the rocks; third, the number and character of subdivisions already recognized or likely to be recognized in the future; fourth, contemporaneous earth movements (each system is supposed to represent in general a widespread sinking of continental areas, accompanied by deposition of sediments and followed by a general uplift).

I have found the need of adopting a standard time scale for the publications of the Pennsylvania Geological Survey. A preliminary study revealed no time scale universally accepted. State and federal surveys and textbooks differ in their usage. The principal subdivisions are the same but with major differences. For example: the U. S. Geological Survey treats the Cre-

PALEOZOIC (Ancient Life)
Era of Invertebrates, Fish, Amphibians
Maximum thickness of rocks, 100,000 ft. (average 25,000 ft.). Estimated duration, 400,000,000 years.

LATE PALEOZOIC or CARBONIFEROUS (1821) Maximum thickness, 24,000 ft. (Average thickness, 9,500 ft.) 115,000,000 years Age of coal and amphibians—Evolution of reptiles	H. PERMIAN (1841) Maximum thickness, 13,000 ft. Average thickness, 2,000 ft. Duration, 35,000,000 years	UPPER	50 Upper 49 Lower
		LOWER or OKLAHOMA Thickness in Pennsylvania, 1,300 ft.	48 Cimarron, Kan. (1896) 47 Big Blue, Kan. (1896)
	G. PENNSYLVANIAN (1888) Maximum thickness, 20,000 ft., in Arkansas Average thickness, 6,000 ft. Duration, 40,000,000 years	UPPER or PITTSBURGH (New) Thickness in Pennsylvania, 1,600 ft.	46 Monongahela, Pa. (1840) 45 Conemaugh, Pa. (1874) 44 Allegheny, Pa. (1840)
		LOWER or POTTSVILLE (1877) Thickness in Pennsylvania, 1,100 ft.	43 Kanawha, W. Va. (1877) 42 New River, W. Va. (1874) 41 Pocahontas, Va. (1896)
	F. MISSISSIPPIAN (1870) Maximum thickness, 7,000 ft. Average thickness, 1,500 ft. Duration, 40,000,000 years	UPPER or TENNESSEE Thickness in Pennsylvania, 3,000 ft.	40 Chester, Ill. (1857) 39 St. Louis, Mo. (1847)
		LOWER or WAVERLY Thickness in Pennsylvania, 1,300 ft.	38 Osage, Kan. (1888) 37 Kinderhook, Ill. (1866)
MIDDLE PALEOZOIC or SILURO-DEVONIAN Maximum thickness, 20,000, ft. (Average thickness, 5,000 ft.) 90,000,000 years Age of fish—Evolution of amphibians	E. DEVONIAN (1839) Maximum thickness, 20,000,000 ft. Average thickness, 4,000 ft. Duration, 50,000,000 years	UPPER or SUSQUEHANNA (New) Thickness in Pennsylvania, 3,000 ft.	36 Chemung (inc. Catskill), N. Y. 35 Portage, N. Y. (1840) 34 Genessee (inc. Tully), N. Y.
		MIDDLE or ERIE Thickness in Pennsylvania 800-14,000 ft.	33 Hamilton, N. Y. (1839) 32 Marcellus, N. Y. (1838) 31 Onondaga, N. Y. (1838)
		LOWER or MORGAN (New) (Morgan County, W. Va.) Thickness in Pennsylvania, 1,000 ft.	30 Oriskany, N. Y. (1838) 29 Helderberg, N. Y. (1838)
	D. SILURIAN (1835) Maximum thickness, 7,300 ft., in Massachusetts Average thickness, 2,000 ft.	UPPER or CAYUGA (1864) Thickness in Pennsylvania, 1,300 ft.	28 Monroe, Pa. (1882) 27 Salina, N. Y. (1863)
		LOWER or ONTARIO (N. Y., 1843)	26 Niagara, N. Y. (1842) 25 Clinton, N. Y. (1841) 24 Medina, N. Y. (1839)
EARLY PALEOZOIC or CAMBRO-ORDOVICIAN Maximum thickness, 55,000 ft. (Average, 10,000 ft.) Estimated duration, 200,000,000 years Age of invertebrates—Evolution of vetebrates	C. ORDOVICIAN (1879) Average thickness, 4,500 ft., in Pennsylvania Duration, 60,000,000 years	UPPER or CINCINNATI (1859) Thickness in Pennsylvania, 2,800 ft.	23 Oswego, N. Y. (1841) 22 Hudson, N. Y. (1840) 21 Utica, N. Y. (1841)
		MIDDLE or MOHAWK (1840) Thickness in Pennsylvania, 500 ft.	20 Trenton, N. Y. (1837) 19 Black River, N. Y. (1842)
		LOWER or CHAZY (N. Y., 1842) Thickness in Pennsylvania, 1,000 ft.	18 Blount, Tenn. 17 Stones River, Tenn. (1851) 16 Big Buffalo, Ark.
	B. CANADIAN (1874) Average thickness, 3,000 ft., in Pennsylvania Duration, 50,000,000 years	UPPER or BEEKMANTOWN (1890) Thickness in Pennsylvania, 2,500 ft.	15 Bellefonte & Axeman, Pa. (1911) 14 Nittany, Pa. (1911) 13 Stonehenge & Schaghticoke (1903)
		LOWER or OZARK (1891) Thickness in Pennsylvania, 300 ft.	12 Gasconade, Mo. (1892) 11 Copper Ridge, Tenn. 10 Little Falls, N. Y. (1903)
	A. CAMBRIAN (1835) Maximum thickness, 40,000 ft., in British Columbia Average thickness, 4,000 ft.+ Duration, 90,000,000 years	UPPER or SARATOGA (1903) Thickness in Pennsylvania, 3,600 ft.	9 Hoyt, N. Y. (1910) 8 Potsdam, N. Y. (1838) 7 St. Croix, Wis. (1873)
		MIDDLE or ACADIA (1874) Thickness in Pennsylvania, 4,000 ft.	6 Upper 5 Middle 4 Lower
		LOWER or WAUCOBA (1912) Thickness in Pennsylvania, 5,800 ft.	3 Upper 2 Middle 1 Lower

taceous and Carboniferous as systems, whereas several modern textbooks divide the Cretaceous into two systems and the Carboniferous into three systems. In starting the publications of a new series of reports it seemed desirable to review the whole subject critically and if possible to make a time scale combining the best available information.

The various subdivisions of the table might be compared to divisions of human history. The "periods" might be likened to dynasties in the history of Egypt, the "epochs" to individual reigns; the "ages" or systems may then represent a group of dynasties or a long period in human history. Just as dynasties and individual reigns differ in length and importance, the ages, periods, and epochs in geologic history doubtless are of unequal length and value.

In reaching the conclusions, all pertinent factors were considered. Thus, the Cambrian system is not divided, although probably as long and the rocks several times as thick as the Silurian. Cambrian time, though apparently favorable to thick rock formation, did not foster rapid development of life forms, so that minute subdivisions on the basis of the fossils is almost impossible. However, some of the later systems represented by relatively thin series of rocks are so fossiliferous as to be divisible into many thin zones. This division multiplied the number of individual bed names.

Neogene and Eogene, as here used, have been used for some years for the Tertiary. Textbooks have used Comanchian for Lower Cretaceous for about twenty years. Geologists recognize that the Comanchian in America is not exactly the same as the Lower Cretaceous in Europe. Cordilleran is therefore introduced to designate the time and the rocks from the end of the Comanchian to the beginning of the Eogene. Permian, Pennsylvanian, and Mississippian, as subdivisions of the Carboniferous, have been used for many years. The Ordovician, though estimated to be of nearly the same duration as the Carboniferous, has here been divided into two parts, Ordivician and Canadian. Some geologists would classify the Ozark rocks as one system, the Beekmantown and Chazy as a second, and the Mohawk and Cincinnati as a third. My studies, however, have failed to convince me that either the Ozark or Cincinnati rocks are of correlative rank with Silurian, Devonian, Pennsylvanian, or Jurassic. The Ozark "period," including the upper part of the "Ozarkian system" of Ulrich, is placed in the Canadian. The lower part of Ulrich's "Ozarkian system" is included in the Cambrian. The Cambrian, although of long duration and comprising a great thickness of rocks, is considered as one system, as it is not readily divisible.

The rocks have been divided into systems and the systems subdivided into two or three "periods," which are designated as upper, middle, and lower, or upper and lower. It has been customary to name these periods. The Jurassic periods have not been given geographic names, because the Jurassic is not well represented in this country. Several names are used here in a broader sense than is customary. For example: Montana is used for the Upper Cordilleran, as including all rocks between the top of the Colorado and the base of the Eocene. The Montana therefore includes the Laramie, which was formerly independent. The Dakota sandstone has been included with the Colorado series in the Lower Cordilleran system.

In like manner each series or period has been divided into two to five groups, each group representing an epoch of time. Most of these groups have been known in the past as "formations" or the smallest unit that can or is likely to be shown on a map. More detailed work, however, has divided formations into named parts and subdivisions that are often recognized across several states. In illustration: The Allegheny group, (formerly the Allegheny formation), is now divided into the Freeport, Kittanning, and Clarion formations. Each of these formations is comprised of several beds of coal, clay, limestone, sandstone, and shale. Thus, the Freeport formation contains (in descending order): Freeport, upper coal; Freeport, upper clay; Freeport, upper limestone; Bolivar, flint clay; Butler, sandstone; unnamed shales; Freeport, lower coal; Freeport, lower clay; Freeport, lower limestone; Freeport sandstone; unnamed shales. To show how minutely the whole time scale has been divided, the Devonian subdivisions recognized in New York State are given. (It will be evident why the old Hamilton "formation" is here called a "group"). What is true of the Devonian is true in general of the other systems.

Table of Devonian "Formations" in New York

System	Series	Groups	Formation or Beds
Devonian	Upper Devonian or Susquehanna	Chemung	Catskill beds Cuba sandstone Shumla sandstone Wellsburg sandstone Cayuga shale Rensselaer grit
		Portage	Wiscoy shale Nunda sandstone Gardeau flags Dunkirk shale Hanover Angola Rhinestreet shale Cashaque shale Parrish limestone Middlesex shale
		Genessee	Standish flags and shale West River shale Genundewa limestone Black shale (type) Tully limestone
	Middle Devonian or Erie	Hamilton	Moscow shale Menteth limestone Tichener limestone Ludlowville shale Centerville limestone Skaneateles shale
		Marcellus	Cardiff shale Stafford limestone Black shale (type) Cherry Valley limestone
		Onondaga	Limestone (type) Schoharie grit
	Lower Devonian or Morgan	Oriskany	Esopus grit Sandstone (type) Glenerie limestone Connelly conglomerate Port Ewen limestone
		Helderberg	Becraft limestone New Scotland limestone Kalkberg limestone Coeymans limestone Keyser beds

This time scale was made with two ideas in mind: first, to make a time scale in which the various "systems," "series," "groups," and "formations" would be of comparable rank. Thus a "group" of rocks has an average thickness of several hundred feet but usually less than a thousand feet. A "series" averages several thousand feet thick. The "systems" are usually represented by tens of thousands of feet. The "formations" are a few hundred feet thick, or more commonly less than one hundred feet. The thicker members of these correlated divisions usually represent masses of rocks apparently incapable of ready subdivision.

The second object was to devise, if possible, some method by which the position of any bed in the strati-

graphic column could be handily designated. After the table was practically in the present form, I noticed that there were almost exactly one hundred epochs. Therefore, if it is assumed that all time from the beginning of the Cambrian had been divided into one hundred more or less equal epochs, and if these were numbered from 1 to 100, the general position of any epoch in the column would at once be clear. Furthermore, many rock groups in Pennsylvania, as in other places, do not exactly correlate with the epochs indicated in the time scale. Thus, in Pennsylvania, a broad belt of rock known as the Martinsburg shale is equivalent, on fossil evidence, to rocks from the base of the Trenton to the top of the Hudson. The stratigraphic position of that shale can therefore be readily indicated by the use of the numbers 20-22 inclusive. The Kittatinny limestone, for example, extends stratigraphically from the base of the Little Falls to the top of the Bellefonte. Its stratigraphic position therefore can readily be indicated as from 10-15 inclusive.

The Use of Numerical Symbols

In order to have exactly 100 epochs, the table as originally written was slightly modified. Thus, in the Upper Devonian five epochs, the Tully, Genesee, Portage, Chemung, and Catskill, were reduced to three. The Tully, a very thin limestone occupying a relatively limited area in central New York, and unworthy of group rank, was combined with the Genesee. Likewise the Catskill was combined with the Chemung, as it has long been known to be in part, if not in whole, simply the eastward extension of the Chemung.

The Pennsylvania Geological Survey proposes to use the name of a formation or bed with its group name. Thus, the Becraft limestone would be referred to (except where used frequently) as the Helderberg limestone, 29 (Becraft). The name Helderberg, in use since 1838, has gained certain familiarity which at once reveals to the frequent reader of geological reports the place of the Becraft limestone. The number 29 shows that the rock is a little above the middle of the Paleozoic and should be of greater value in reminding the reader of the relative position of several beds mentioned.

The time scale presented is the result of study extending over several years. Blueprints of the proposed Standard Time Scale were distributed widely among geologists and comment was invited. As the result of such comment further studies were made, and a revised time scale was sent to those who had responded the first time. The criticisms of this second time scale have been carefully considered and used in the final draft.

In the table here given account has been taken of what might be called the "historic" periods only. Below the Cambrian lie great thicknesses of rocks believed to represent vast areas of time during which life was slowly unfolding; but of that life only the most meager traces remain unless we except limestones, iron ores, and certain other rocks as prima facie evidence of life.

Thus, before the Paleozoic era came the Proterozoic and Archiozoic eras, each possibly as long or longer than the Paleozoic. The Proterozoic, represented by Algonkian rocks, which in Canada are estimated to have a thickness of 74,000 ft., is divided into the Keweenawan and Huronian ages or systems. Archiozoic time, represented by Archean rocks, with an estimated thickness in Canada of 94,000 ft., has been divided into Laurentian and Keewatin time.

The kindly criticism of numerous geologists is hereby acknowledged.

Recent Cyanide Practice

The following editorial, which appeared in *The Mining Magazine* for February, will no doubt interest American gold metallurgists:

"Much has been heard during recent months of the adoption of all-sliming at certain mines in the Far East Rand, with the concomitant elimination of stamps and amalgamation. This modification of practice was first made at the properties of the Consolidated Mines Selection group, and later it was announced that the process was to be adopted at the plant of the New State Areas, the new mine belonging to the Johannesburg Consolidated group. By many it has been considered remarkable that all-sliming was not adopted on the Rand fifteen or more years ago, seeing that it had then become current practice in the United States and Mexico for the treatment of sulphide gold and silver ores. The somewhat illogical position in this connection is accentuated by the fact that in some of the latest plants built in America for the cyaniding of silver and gold ores reversion is now made to sand leaching. As instances, we may take two of the largest new plants, the United Comstock and the Candelaria, both in Nevada, each constituting an example of the latest American practice. At the United Comstock the sand is leached in vats, and the slime is agitated in Dorr machines and the solution removed by leaf filters; the combined solutions, after being clarified, are de-aërated in Crowe vacuum receivers and the silver and gold are precipitated by the Merrill zinc-dust process. At the Candelaria plant the lay-out is much the same, except that rotary drum filters are used instead of leaf filters. The United Comstock ores vary considerably in grade, and the values of the gold and silver constituents are about equal. The gold and silver are largely associated with sulphides, which can be liberated by reducing the ore to from 20 to 45 mesh. Table concentration is employed, and thus the feeds to the sand and slime plant are rendered fairly constant. The concentrate is ground very fine and cyanided separately, and, after a decanting wash, is sent to the slime circuit for final washing and filtration. At the Candelaria mine silver is much the predominant metal. It exists partly as chloride and other easily soluble compounds and partly in association with manganese and other insoluble compounds which require roasting. A high proportion of coarse sand is made in comminution, and, after leaching, portions of the sand are roasted and re-leached. The object of the preliminary leach of coarse sand is to avoid the volatilization losses usually experienced when chlorides are roasted, and incidentally it avoids dry crushing.

"That all-sliming is not entire acceptable to Rand engineers is evidenced by the fact that at Modder Deep a new process is being tested for submitting the sand to flotation, cyaniding the sand tailing in vats, and sliming the pyritic product and sending it to the slime plant.

"Mention is made above of the Crowe and Merrill processes. The latter is already well established as an improvement on the usual zinc-shaving precipitation method, and the former, a comparatively new introduction, effects substantial economies in the consumption of zinc and cyanide during precipitation, owing to all oxygen having been removed from the gold solution. During the last year both processes have been introduced at the Springs and Geduld mines, and the Crowe process has been adopted at the Shamva, in Rhodesia, and the Taquah and Abosso, in West Africa. All the gold mines in Canada use both processes, and in India the Crowe process is employed. It may be expected, now that the results in Africa have proved perfect precipitation to be obtainable even with the lowest possible strengths in cyanide and alkali, that engineers will further investigate such advantages claimed for the zinc-dust precipitation method as lower zinc consumption, higher grade of the precipitate, and the more rapid realization of the gold."

Sintering to Increase Returns to Ore Shippers

Usually Any Process That Will Lessen the Weight of a Lot of Ore or Concentrate Without Dissipating the Valuable Metals Will Benefit the Producer

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I HAVE BEEN READING with much interest A. B. Parsons' articles on marketing metalliferous ores and concentrates, in the Dec. 23 and Dec. 30 issues of the *Journal-Press*, in which he points out in a very clear manner how the ore producer, particularly the small one, frequently gets less for his ore than he might if he were more careful in making his contracts with the smelter. These articles also draw attention to the benefit to be gained by preparing the ore in various ways so as to take the maximum advantage of the contract once it is made. In this article I shall point out how sintering ore before shipment, by either a small shipper or a large one, might, in a great majority of instances, effect savings that more than offset the cost of the sintering operation.

The ore producer who does not take the trouble to analyze his contract before signing it has no one to blame but himself for the results. If the miner has not the time or inclination to analyze his contract even after it is made, he can have such an analysis made by a competent engineer at slight expense. I know of many cases where the saving on one single carload of ore would have paid the cost of such expert advice several times over. The miner sometimes has methods of reasoning that are too deep for the average man to fathom and "for ways that are dark and tricks that are vain," he often goes the "heathen Chinee" one better.

I remember once seeing an imposing convoy drive into the Salida (Colorado) smelter. This outfit was got up according to the best present-day movie traditions. At the head of the procession came a man on horseback, holding across the pommel of his saddle a rifle ready for action. Behind him came a covered wagon, on the seat of which two men sat. Each of these was fitted out with a cartridge belt, with the handle of a real old-time "Colts 45" protruding from the holster. One of the men was driving the wagon while the other held a loaded rifle across his knees ready for action. Behind the wagon rode another armed horseman. These people had come from a mine back of Leadville, having driven the entire distance, because they were afraid to trust their rich ore to the railroad for shipment. The contents of the wagon, as I remember, amounted to about 3,000 lb., all in sacks, and divided into eight or more lots. While it was being sampled it was watched day and night by one of the armed guards. The total value of the entire 3,000 lb. proved after assay to amount to something like $30. After the cost of the extra sampling and assaying was figured out, the owners of the ore actually owed the smelter a balance. These miners could have had an assay made in Leadville for a few dollars and saved themselves all the trouble and expense of their trip.

Let us consider the miner who has actually signed a contract, favorable or otherwise. Is there anything he can do that will not entail much outlay for equipment and that will increase his returns from his ore? Mr. Parsons speaks of sorting the ore. This will frequently pay, and I have often seen shipments where a rough sorting at slight expense would have cut down the number of tons to be shipped by one-quarter, leaving 95 per cent of the total values in the three-quarters shipped.

I remember an instance where a mining company, simply by screening its ore through an ordinary sand screen, separated it into two products, one with values so low that it could be discarded, and the other with values high enough to show good returns from the smelter.

Anything which will reduce the weight of a given lot of ore and at the same time take out none of the values will benefit the shipper. Absorbed moisture, if eliminated, will reduce the amount to be paid for freight, as pointed out by Mr. Parsons. If the net dry weight of the material can be reduced still further, additional savings are possible as follows:

1. Lower freight charge in consequence of fewer number of tons.
2. Lower smelting charge in consequence of a fewer number of tons.
3. Gain on arbitrary deductions due to analysis.

Sundry Stipulations in Contract Offer Opportunity for Improving Condition of Ore

For instance, a contract calls for payment for copper less 1.3c. units, or 26 lb., of copper per ton. There is a net gain of these 26 lb. on each ton by which the weight of the shipment is reduced. The same would be true in the case of a lead ore, where fire assay is specified as the basis for settlement, because this amounts in substance to an arbitrary deduction of 1.5 units of lead. In some cases there may be a gain because by reducing the number of tons the metal content of the remainder is increased enough to bring a premium. For example: One form of contract provides for a base of 30 per cent lead with a certain base smelting charge and a debit of 10c. per unit for each unit of lead below 30, and a corresponding credit of 10c. per unit for each unit above 30. In such a case there would be a gain of 30c. per ton if the lead content could be raised three units. Again, in the case of gold and silver, these are not paid for if under a certain minimum. An ore might contain just under the minimum. There would be cases where this amount would be raised above that minimum, in which case the gold or silver contents would be paid for by the smelter.

Further saving may be effected by:

4. Elimination of penalties for deleterious elements. If in bringing about this reduction in weight some of the penalized elements in the ore can be partly or entirely eliminated, there is again a gain.
5. Reduction in weight by eliminating combined gases such as CO_2 and oxygen.
6. Reduction in weight by eliminating moisture and chemically combined water.

All of the above will be accomplished in greater or

less degree by sintering the ores before shipment. An attractive feature is that contained sulphur, penalized by the smelter and constituting part of the weight of the ore, can usually be made to furnish the heat necessary to eliminate itself as well as other penalized or non-revenue producing elements. Another consideration is that sintering differs from any other method which can be used to concentrate the weight of the ore, in that no values are lost. In sorting, or in magnetic or wet concentration, some values are always left in the tailing, but in sintering, that part of the ore which is driven off or rejected carries no values with it. I do not mean necessarily the careful sintering that a smelter will do, but rather a crude and simple sintering the main object of which will be reduction in weight of the ore. Of course, the greater the care with which it is done, the greater will be the gross gain, but beyond a certain point the gain may be offset by the increased cost of the sintering operation. The smelter has every interest to carry it as far as possible because of the marked effect of the physical character of the sintered product on the blast-furnace operation. The ore shipper, on the other hand, would not be interested in this phase unless the smelter were willing to give him a lower smelting rate because of this improved physical condition. In such a case it might pay to do careful sintering.

Sintering can be carried on in a simple manner and with small outlay for equipment, if the tonnage is small and the physical character of the product is not of prime importance. This sort of sintering can be done if desired by up-draft, though it will usually be found that the better results obtained by down-draft operation will more than offset the small charge made for the use of the patented down-draft process. It will pay a shipper having large tonnages to put in a more elaborate and expensive plant, because of the better results he will be able to obtain, and because with such larger tonnages the more elaborate plant will show lower costs of operation per ton than will the simple inexpensive one.

Ore shipments received by the smelters may be roughly divided into three classes: Oxidized ores, sulphide ores, and sulphide concentrates. Oxidized ores do not contain any element to act as fuel, so that the cost of the small percentage of fuel necessary would have to be taken into consideration. A coarse siliceous ore manifestly could not be sintered profitably, whereas a fine limonite, with 15 or 20 per cent combined water, would show a decided profit. It will usually pay to sinter sulphide ore, as the sulphur in the sulphides will furnish the fuel, and the sulphur content usually is penalized. It would almost invariably pay to sinter sulphide concentrates. The only exception would be in a case where the smelting charge was exceedingly low and the mine was situated close to the smelter, so that the freight rate was also low. Sulphide concentrates contain sufficient sulphur to furnish the heat required for sintering, and unless specially dried they almost invariably contain much mechanically held water. Flotation concentrates in particular contain so much water that it is justly penalized by the smelter. Anyone in doubt as to the fairness of this penalty is urged to unload in winter time a car of flotation concentrate that was shipped wet. Even in summer one would have an interesting time. Many shippers now dry their flotation concentrates, using extraneous fuel to furnish the heat. This costs money, frequently as much as it would to sinter. None of the latter's special advantages accrue, such as the utilization of the sulphur as fuel, and decrease in weight due to the sulphur eliminated. Concentrates are frequently sacked before shipment to avoid loss from leakage in transit. Once sintered, this expense can be eliminated, as the sinter is coarse and not subject to such leakage.

Years of experience have shown that practically all ores after sintering show a loss in weight of 10 to 15 per cent from the dry weight of the ore. It is also evident that all absorbed moisture is driven off in sintering. The following table shows why such loss in weight occurs in sintering; it gives the per cent loss for different common numerals of copper, lead, and iron, which, aside from silica, constitute the principal part of ordinary ores. The table shows the loss in weight due to complete reactions, although, of course, in sintering the reaction will be only partial, depending on how far it is desirable to carry the sintering. It will be noted in the table that I have given, in the case of iron minerals, the loss in weight due to a reduction to Fe_3O_4 and also to FeO.

If an iron mineral is sintered in the presence of silica the reduction will be to FeO, which will combine with the silica to form a silicate. Where silica is absent or present only in small quantities as compared to the iron, the reduction will be largely to Fe_3O_4. In the case of sulphides, the sulphur eliminated is replaced by oxygen.

Theoretical Results of Sintering Various Minerals

Mineral	Chemical Formula	Sintered to	Element Removed	Reduction in Weight With Complete Reaction, Per Cent
Azurite (*a*)	$Cu_3(OH)_2(CO_2)_2$	3 CuO	Co_2+H_2O	26.6
Bornite	Cu_5FeS_4	5 CuO FeO	S	6.13
Chalcocite	Cu_2S	CuO	S	.....
Chalcopyrite	$Cu_2S\ Fe_2S_3$	2 CuO, 2 FeO	S	17.4
Malachite	$Cu_2(OH)_2CO_2$	2 CuO	H_2O+CO_2	22.5
Chrysocolla	$CuSO_3\ 2H_2O$	$CuSO_3$	H_2O	20.5
Galena	Pb S	PbO	S	6.7
Cerrusite	$PbCO_3$	PbO	CO_2	16.5
Silica	SiO_2	.....	none	.....
Pyrite	FeS_2	Fe_3O_4	S	35.5
Pyrite	FeS_2	FeO	S	40
Pyrrhotite	FeS	Fe_3O_4	S	12
Pyrrhotite	FeS	FeO	S	18
Hematite	Fe_2O_3	Fe_3O_4	O	3.2
Hematite	Fe_2O_3	FeO	O	10.0
Limonite	$Fe_2O_3Fe_2(OH)_6$	Fe_3O_4	$O+H_2O$	17.2
Limonite	$Fe_2O_3Fe_2(OH)_6$	FeO	$O+H_2O$	23.0
Siderite	$FeCO_3$	FeO	CO_2	38.0
Siderite	$FeCO_3$	Fe_3O_4	CO_2	33.0
Magnetite	Fe_3O_4	FeO	O	7.0
Gypsum	$CaSO_4—2H_2O$	$CaSO_4$	H_2O	20.7
Gypsum	$CaSO_4—2H_2O$	CaO	SO_3+H_2O	67.0
Calcite	$CaCO_3$	CaO	CO_2	44.0
Dolomite	$MgCO_3CaCO_3$	MgOCaO	CO_2	47.8

(*a*) Chemical formulas as given by A. J. Moses in Peele's Handbook.

The elements in the accompanying table that can be eliminated may be divided in two classes: (1) Those which are responsible for added weight and (2) those which are responsible for added weight and also subject to penalties. In class (1) are water under 5 or 6 per cent, carbon dioxide, and sometimes oxygen. In class (2) are sulphur, arsenic, and antimony, which are almost always penalized above certain limits. Water also falls in this class when above 5 or 6 per cent. The elements in class (1) except oxygen are entirely eliminated by sintering. Of those in class (2) water is entirely eliminated. The sulphur content may be reduced to less than 1 per cent if profitable. The arsenic content can be materially reduced, and under certain conditions antimony can be partly eliminated. Let us take for illustration a lead flotation concentrate having an analysis as follows: Lead, 45 per cent; iron 12 per cent; sulphur, 13 per cent; silica, 20 per cent, and containing 10 per cent moisture treated by the smelter

under a schedule as follows: Flat treatment charge per ton, $8; excess moisture penalty per ton, $1.50; freight to smelter, per ton, $6. The gains possible by sintering 100 tons of this concentrate into 90 tons of sinter are as follows:

Moisture penalty on 100 tons @ $1.50	$150
Treatment charge on 10 tons @ $8.00	80
Freight 10 tons moisture, 10 tons shrinkage in weight due to sintering 20 tons @ $6.00	120
Total	$338

From this, of course, the cost of sintering would have to be deducted.

My figures are based on the assumption that practically all ores or concentrates as shipped to the smelter will contain a minimum of 5 per cent moisture, unless specially dried, and that the shrinkage from the net dry weight of the ore before sintering will be at least 10 per cent, a figure which is borne out by years of actual experience.

The ore analyses and the smelter settlement schedules given in Mr. Parsons' article of Dec. 30 are typical of the ores produced and the smelter rates prevailing in different parts of the United States. Mr. Parsons has given me permission to use these, and I am, therefore, taking them bodily as published in his article. Each settlement shows what was actually received from an ore or concentrate. Under each settlement I show what additional return could have been received from this shipment had it been sintered before shipping.

SETTLEMENT I

COPPER CONCENTRATE

Analysis: Cu, 20.5%; SiO_2, 22%; Fe, 28%

Gross Value		
Gold, Silver } Negligible		
Copper—410 lb. @ 14c.	$57.40	$57.40
Credit on Smelter Settlement		
Copper—(410—12) lb. @ 14c.	$55.72	
Debit		
Nominal smelting charge	6.00	
Freight on blister to refinery, 398 lb. @ $14.50 per ton	2.88	
Refining charge 398 lb. @ (a) $17 per ton	3.38	
Selling expense—1%	0.55	
Interest for 90 days—1%	0.55	
	$13.36	
Proceeds from smelting		42.36
Actual treatment charge		$15.04
Freight on concentrate		
Actual value of concentrate at mill		$42.36

No saving to be made, as concentrates are treated on a cost plus basis, and there is no freight to pay.

SETTLEMENT II

COPPER CONCENTRATE

Analysis: Au, 0.09 oz.; Ag, 8.1 oz.; Cu, 30.1%; SiO_2, 20.2%; Fe, 13.8%; CaO, 0.8%; S, 18.7%.

Gross Value		
Gold—0.09 oz. @ $20.67	$1.86	
Silver—8.1 oz. @ $1	8.10	
Copper—602 lb. @ 13.875c.	83.52	$93.48
Credit on Smelter Settlement		
Gold—0.09 oz. @ $19	$1.71	
Silver—95% of 8.10 oz. @ 99½c.	7.66	
Copper—97½% of 602 lb. at (13.875—2.75)c.	65.29	
Iron—13.8 units @ 5c.	0.69	
Bonus on treatment	0.50	
Treatment nil at 15c. copper; 50c. for each ½c. above 15c. to maximum of $2.50. Allowance of 50c. when copper quotation is below 15c.		
	$75.85	
Debit		
Insoluble—20.2 units @ 7c.	$1.41	
Proceeds from smelting		74.44
Actual treatment charge		$19.04
Freight to smelter		6.90
Treatment and freight		$25.94
Actual value of ore at the mine		67.54
By sintering:		
Save		
Freight on 15 tons @ $6.90		$103.50
Lose		
Bonus of 50c. per ton on 10 tons		5.00
Gain per 100 tons		$98.50

SETTLEMENT III

COPPER CONCENTRATE

Analysis: Au, 2.54 oz.; Ag, 4.8 oz.; Cu, 7.12%; Fe, 45.8%.

Gross Value		
Copper—142.4 lb. @ 14c.	$19.93	
Gold—2.54 oz. @ $20.67	52.50	
Silver—4.8 oz. @ $1	4.80	$77.23
Credit on Smelter Settlement		
Copper—90% of 142.7 lb. @ (14—3½)c.	$13.49	
Gold—95% of 2.54 oz. @ $20	48.26	
Silver—95% of 4.8 oz. @ 99½c.	4.55	
	$66.30	
Debit		
Nominal treatment (flat rate per ton)	$6.00	
Proceeds from smelting		$60.30
Actual treatment charge		$16.93
Freight to smelter		8.50
Treatment and freight		$25.43
Actual value of concentrate at mine		51.80
By sintering:		
Save		
Freight on 15 tons @ $8.50		$127.50
Treatment charge on 10 tons @ $6.00		60.00
Gain per 100 tons		$187.50

SETTLEMENT IV

COPPER ORE

Analysis: Au, 0.015 oz.; Ag, 3.625 oz.; Cu, 13.28%; Zn, 1.5%; SiO_2, 53.9%; Fe, 6.8%; S, 11.65%; As, 0.8%.

Gross Value		
Copper—265.6 lb. @ 13.725c.	$36.45	
Gold—0.015 oz. @ $20.67	0.31	
Silver—3.625 oz. @ $1	3.62	$40.38
Credit on Smelter Settlement		
Copper—(265.6—15) lb. @ (13.725—3)c.	$26.88	
Silver—3.625 oz. @ 99.25c.	3.60	
	$30.48	
Debit		
Nominal treatment charge	$6.25	
5% of value of silver	0.18	
3c. on 95% of silver	0.10	
	$6.53	
Proceeds from smelting		$23.95
Actual treatment charge		$16.43
Freight to smelter		2.45
Treatment and freight		$18.88
Actual value of ore at mine		21.50
By sintering:		
Save		
Freight on 15 tons @ $2.45		$36.75
Treatment on 10 tons @ $6.25		62.50
Gain per 100 tons		$99.25

SETTLEMENT V

SILVER ORE

Analysis: Au, 0.14 oz.; Ag, 28.3 oz.; SiO_2, 82%; Fe, 4.2%; S, 4.3%; As, 0.41% Sb, 0.15%.

Gross Value		
Gold—0.14 oz. @ $20.67	$2.89	
Silver—28.3 oz. @ 1.00	28.30	$31.19
Credit on Smelter Settlement		
Gold—95% of 0.14 oz. @ $20	$2.66	
Silver—95% of 28.3 oz. @ 99½c.	26.77	
	$29.43	
Debit		
Nominal treatment charge (minimum)	$9.00	
Proceeds from smelting		$20.43
Actual treatment charge		$10.76
Freight to smelter		7.50
Treatment and freight		$18.26
Actual value of ore at the mine		12.93
By sintering:		
Save		
Freight on 15 tons @ $7.50		$112.50
Treatment on 10 tons @ $9.00		90.00
		$202.50

This ore does not contain enough sulphur to furnish its own fuel, and the cost of about 3 per cent of fuel that would have to be added must be deducted from the savings. Assume three tons of slack coal or coke at $10 per ton delivered, $30, and the gain per 100 tons would be $172.50.

Settlement VI illustrates the type of contract that an inexperienced miner may tie himself up with. It is a most disadvantageous one for the ore producer. This is a case where it would have paid many times over to have had the contract analyzed by an expert before signing it. This ore producer can help himself materially by sintering and to a certain extent retrieve himself from the results of the bad contract which he made.

SETTLEMENT VI

SILVER CONCENTRATE

Analysis: Au, 1.28 oz.; Ag, 255.3 oz.; Cu, 0.11%; SiO_2, 30.6%, Fe, 28.5%; S, 30.8%; As, 4.06%; Sb, 1.62%.

Gross Value		
Gold—1.28 oz. @ $20.67	$26.45	
Silver—255.3 oz. @ $1	255.30	
		$281.75
Credit on Smelter Settlement		
Gold—95% of 1.28 oz. @ $20	$24.32	
Silver—95% of 255.3 oz. @ 99⅛	241.62	
	$265.94	
Debit		
Arsenic combined with antimony—(5.68—1) unit @ $2	$9.36	
Nominal treatment (maximum)	14.00	
	$23.36	
Proceeds from smelting		$242.58
Actual treatment charge		$39.17
Freight to smelter		15.40
Treatment and freight		$54.57
Actual value of concentrate at mine		$227.18

He can sinter (*a*) in the ordinary way or (*b*) in a careful manner and with a view to getting the greatest possible elimination of the penalized arsenic. Then:

(*a*) Sinter so as to reduce sulphur to 15%, arsenic plus antimony to 2%; net dry weight, 10%.

Save	
Freight on 15 tons @ $15.40	$231.00
Treatment on 10 tons @ $14.00	210.00
Penalty on 2 units As and Sb per ton @ $2.00	400.00
Gain per 100 tons	$841.00

(*b*) Sinter so as to reduce sulphur to 5%, arsenic plus antimony to 1.68%; net dry weight 15%.

Save	
Freight on 20 tons @ $15.40	$308.00
Treatment on 15 tons @ $14.00	210.00
Penalty on 4 units as @ $2.00	800.00
Gain per 100 tons	$1,318.00

It would cost this shipper about twice as much to get result (*b*) as result (*a*), but as the cost of getting result (*b*) would not exceed $1 per ton more than to get result (*a*) there would be a net additional gain of $375 on each 100 tons by attaining result (*b*).

SETTLEMENT VII

DRY ORE

Analysis: Au, 0.08 oz.; Ag, 54.4 oz.; Cu, 2.665%; Pb, 4.5%; Zn, 2.05%; SiO_2, 58.3%; Fe, 12.55%; CaO, 0.2%; S, 15.7%; As, 1.0%.

Gross Value		
Copper—53 lb. @ 13.725c.	$7.27	
Lead—90 lb @ 5.758c.	5.18	
Silver—54.4 oz. @ $1	54.40	
Gold—0.02 oz. @ $20.67	0.41	
		$67.26
Credit on Smelter Settlement		
Copper—(53—15) lb. @ ($13.725—3)c.	$4.07	
Lead—no payment		
Silver—54.4 oz. @ 99.625c.	54.20	
Gold—0.02 oz. @ $19	0.38	
	$58.65	
Debit		
Nominal treatment charge	$6.00	
Account full payment for silver—should be 95% @ 99.625c.	2.71	
	$8.71	
Proceeds from smelting		$49.94
Actual treatment charge		$17.32
Freight to smelter		2.50
Treatment and freight		$19.82
Actual value of ore at mine		47.44
By sintering:		
Save		
Freight on 15 tons @ $2.50		$37.50
Treatment on 10 tons @ $6.00		60.00
Arbitrary deduction on 15 lb. copper on 10 tons, 150 lb. @ 10.725c.		16.09
Gain per 100 tons		$113.59

SETTLEMENT VIII

LEAD ORE

Analysis: Au, 0.04 oz.; Ag, 22.3 oz.; Cu, 0.42%; Pb, 24.3%; Zn, 4.3%; SiO_2, 30.4%; Fe, 15.75%; S, 22.75%; As, 1.2%.

Gross Value		
Copper—8.4 lb. @ 13.725c.	$1.15	
Lead—486 lb. @ 5.758c.	27.98	
Silver—22.3 oz. @ $1	22.30	
Gold—0.04 oz. @ $20.67	0.82	
		$52.25
Credit on Smelter Settlement		
Copper—(as lead) 90% of 8.4 lb. @ (5.758—1.5)c.	$0.33	
Lead—90% of (486—30) lb. @ 4.258c.	17.47	
Silver—22.302 @ 99.625c.	22.21	
Gold—0.04 oz. @ $19	0.76	
Iron—15.75 units @ 6c.	0.95	
	$41.72	
Debit		
Nominal treatment charge	$2.50	
Account full payment of silver—should be 95% (99.625—3)c.	1.73	
Sulphur—(22.75—2)% @ 25c. maximum	2.50	
Silica—30.4% @ 10c.	3.04	
	$9.77	
Proceeds from smelting		$31.95
Actual treatment charge		$20.30
Freight to smelter		2.00
Treatment and freight		$22.30
Actual value of ore at mine		29.95
By sintering:		
Save		
Freight on 15 tons @ $2.00		$30.00
Treatment on 10 tons @ $2.50		25.00
$1.75 on sulphur penalty per ton		175.00
On 100 tons (by reducing S to 5%) Gain per 100 tons		$230.00

SETTLEMENT IX

LEAD ORE

Analysis: Au, 0.033 oz.; Ag, 33.13 oz.; Cu, 1.175%; Pb, 17.64%; Zn, 3.54% SiO_2, 39.8%; Fe, 14.67%; CaO, 0.06%; S, 20.37%; As, 1.00%

Gross Value		
Copper—23 lb. @ 13.725c.	$3.15	
Lead—352.8 lb. @ 5.758c.	20.32	
Silver—33.13 oz. @ $1	33.13	
Gold—0.033 oz. @ $20.67	0.68	
		$57.28
Credit on Smelter Settlement		
Copper—(as lead) 90% of 23 lb. @ (5.758—1.5)c.	$0.89	
Lead—90% of (352.8—30) lb. @ 4.258c.	12.37	
Silver—33.13 oz. @ 99.625c.	33.01	
Gold—0.033 oz. @ $19	0.63	
Iron—14.67 units @ 6c.	0.88	
	$47.78	
Debit		
Nominal treatment	$2.50	
Account full payment silver—should be 95% @ (99.625—3)c.	2.65	
Additional treatment based on lead content under 21.5% (21.5—17.64) units @ 8c.	0.31	
Sulphur (maximum)	2.50	
Silica—39.8 units @ 10c.	3.98	
	$11.94	
Proceeds from smelting		$35.84
Actual treatment		$21.44
Freight to smelter		2.00
Treatment and freight		$23.44
Actual value of ore at mine		33.84
By sintering:		
Save		
Freight on 15 tons @ $2.00		$30.00
Treatment on 10 tons @ $2.50		25.00
Sulphur penalty on 100 tons at $1.75 (by reducing S to 5%)		175.00
Gain per 100 tons		$212.00

SETTLEMENT X

LEAD CONCENTRATE

Analysis: Ag, 38.3 oz.; Pb, 59.3%; Zn, 8.8%; SiO_2, 8.2%; Fe, 3.4%; S, 16.4%

Gross Value		
Lead—(1,186+30(*a*)) lb. @ 5.605c.	$68.15	
Silver—38.3 oz. @ $1	38.30	
		$106.45

(*a*) Settlement assay is wet analysis from button from fire assay.

Credit on Smelter Settlement		
Lead—90% of 1,186 lb. @ (5.605—1.65)c.	$44.22	
Silver—38.3 oz. @ (99.625—3.5)c.	36.82	
Nominal treatment ($2.50 plus or minus 10c. per unit above or below 30% lead) $2.93—$2.50	0.43	
Iron—3.4% @ 6c.	0.20	
	$81.67	
Debit		
Insoluble—8.2% @ 12c.	$0.98	
Sulphur—maximum [(16.4—2)% at 25c.]	2.50	
Briquetting	1.50	
Account full payment for silver—5% of $36.82	1.84	
	$6.82	
Proceeds from smelting		$74.85
Actual treatment charge		$31.60
Freight to smelter		8.80
Treatment and freight		$40.40
Actual value of ore at mine		66.05
By sintering:		
Save		
Freight on 18 tons @ $8.80		$158.40
Treatment negligible		.....
Sulphur penalty @ $1.75 on 100 tons (if sulphur reduced to 5%)		175.00
Briquetting charge—$1.50 on 100 tons		150.00
Lead on 10 tons due to fire assay equals 1.5 units, which equals 300 lb. @ 90% of 4.955c.		13.38
Gain per 100 tons		$496.78

In the case of settlements VIII, IX, and X, if the sintering were carried out so as to reduce the sulphur content to 2 per cent or under, instead of to only 5 per cent, the entire sulphur penalty of $2.50 would be saved, making an additional gross saving of $75 on 100 tons. It would not cost more than 50c. per ton extra to do this, or $50 on the 100 tons, so that there would be an

extra net gain of $25 per 100 tons to be made by this careful sintering.

The cost of doing the sintering on the above ores would vary, and it is not possible to set a definite figure without making tests on a small scale to determine the conditions under which the ore sinters. It also depends on local costs of power, labor, and fuel. The costs should run somewhere between 50c. per ton and $1.50 per ton, except in the case outlined in (*b*) under Settlement VI, where the cost would probably be about $2 per ton.

SETTLEMENT X*A*
LEAD CONCENTRATE
Analysis same as X

Gross Value		
Lead—(1,186+30) lb. @ 5.605c.	$68.15	
Silver—38.3 oz. @ $1	38.30	
		$106.45
Credit on Smelter Settlement		
Lead—90% of (1,216—25) lb. @ 5.605c.	$60.08	
Silver—95% of 38.3 oz. @ 99.25c.	36.11	
	$96.19	
Debit		
Nominal treatment	$25.13	
Base	$15.00	
Lead over 50% @ 10c.	0.93	
Silver over 35% @ 3c.	0.10	
Lead freight to N. Y. @ $16.50 per ton plus war tax	9.10	
Zinc—(8.8—5) units @ 50c.	$1.75	
Moisture—(8.5—6)% @ 20c.	.50	
	$27.38	
Proceeds from smelting		$68.81
Actual treatment charge		$37.64
Freight to smelter		8.80
Treatment and freight		$46.44
Actual value of ore at mine		60.01
By sintering:		
Save		
Freight on 18 tons @ $8.80		$158.40
Treatment on 10 tons @ $15.00		150.00
Moisture penalty 100 tons @ 50c.		50.00
Gain on lead deduction: 25 lb. per ton on 10 tons equals 250 lb. @ 90% 5.605		12.61
Gain per 100 tons		$371.01

A simple installation would consist of a sintering apparatus either of the intermittent on continuous type, a fan, a motor, and an ignition device. In a small plant of this sort one man could sinter about 10 tons of average material in a shift. The costs would be:

Wages for one man	
Fuel for ignition, not to exceed	$1.00
Power, 100 kw.-hr.	
Miscellaneous, oil, repairs and incidentals	1.00

If we assume the wages as $5 per shift and power at 3c. per kw.-hr., we would have a total of $10 cost for the 10 tons, or $1 per ton. Applying this figure to the various settlements, the gain probably by sintering per 100 tons of ore would be:

III	$87.50	VIII	$130.00
V	72.50	IX	112.00
VI-*a*	741.00	X	396.48
VI-*b*	1,118.00	X-A	271.01
VII	13.59		

With II and IV there would be nothing to be gained unless the sintering could be done for less than $1 per ton. On VI there would be the considerable saving of $7.41, or $11.18 per ton. This alone many ore producers would consider a satisfactory return from their ores. If any of these producers had a tonnage sufficient to warrant the installation of the more expensive type of plant arranged for mechanical handling of the ore and sinter, the cost of $1 per ton for the sintering operation could be reduced.

Any mine having an assay muffle furnace can make a rough determination as to whether or not there would be a gain by sintering. The procedure is this: Make a moisture determination; this will give the shrinkage in weight due to elimination of absorbed moisture. Then ignite and determine loss in weight on ignition. This will give an approximate figure of the loss in weight to be expected by sintering. In the case of sulphides, dry first to obtain moisture content; then roast in the muffle down to about 5 per cent sulphur, taking care to avoid the formation of sulphates. Determine loss in weight. Analyze the product and figure out what the smelter returns minus freight and treatment charge would be on such a product. With this figure and that of the shrinkage in weight, it is easy to ascertain the comparative returns on raw ore and on the sinter made from any given amount of the same ore. These figures would approximate closely the results that would actually be obtained by sintering.

The cost of the installation to do the sintering would depend on the tonnage it was desired to treat per day and the refinements to which it was desired to carry the process. A simple and inexpensive plant to treat 10 tons per shift could be installed with an expenditure of approximately $2,000, and an elaborate one to treat to 100 tons per twenty-hour hours might cost as much as $20,000. A mine like the one considered in settlement VI, which according to Mr. Parsons' figures is presumably producing 20 tons of concentrates per day, could install a small plant for under $5,000 to sinter these in one shift during daylight. With a saving of only $6 per ton, or $120 per day, the sintering plant would be paid for in less than sixty days.

If the suggestions I have made are instrumental in helping any miner who is not now getting the greatest possible returns out of his ore, I shall feel that this article has not been written in vain.

Mining Costs at Butte, Montana

Although it is the policy of the largest copper producer in Butte not to divulge production costs, some of the smaller operators are commendably frank in giving such information. As the mines of the district work deposits which closely resemble each other in character, the costs given by the smaller operating companies reflect costs in the whole district.

The North Butte Mining Co. produces copper from one of the most modern and best-equipped properties in Butte. Its annual report for 1922 gives an insight into copper production costs from which the following table has been taken:

	Cost in Cents Per Pound
Mining and development	.103465
Freight on ore	.003231
Concentration, smelting, freight on bullion, refining and selling expense	.065131
General expense and taxes	.013656
Total operating cost	.185483
Less value of silver and gold	.033238
Net operating cost	.152245

In considering the results of operations the report states that the entire production of the company was made in seven months, which carried twelve months' overhead.

The East Butte Copper Mining Co., which works a vein somewhat narrower than that of the North Butte, also states the cost of copper production in its annual report as 14.7306c. delivered in New York.

India the Gold Sink of the World

The flow of gold into India is causing more concern in many circles than the abundance of gold in the United States, says the *Boston News Bureau*. In the case of India all but a small part of the gold which enters disappears entirely from the international market. It has been estimated that there is now in India more than $2,500,000,000 in gold. This represents the accumulation of 7,000 years.

THE PETROLEUM INDUSTRY

Oil Production in Russia

Preliminary figures for the first quarter of 1923 indicate the total production of the three principal oil fields of Russia as 73,850,000 poods, compared with 75,564,000 for the preceding three months, according to the Department of Commerce. The decrease was principally due to the falling off of Grozny gusher production. The table below gives the production in poods (62 poods equal 1 long ton; 8⅓ poods equal 1 United States barrel):

Production of Oil in Principal Russian Fields

Fields	January Poods	February Poods	March Poods	Total, January-March, 1923 Poods	Total October-December, 1922 Poods
Baku.....	17,520,000	16,171,000	18,062,000	51,753,000	49,625,000
Grozny....	6,737,000	6,161,000	7,197,000	20,095,000	23,773,000
Emba.....	675,000	645,000	682,000	2,002,000	2,166,000
Total....	24,932,000	22,977,000	25,941,000	73,850,000	75,564,000

The average monthly production from all three fields in 1913 was approximately 47,000,000 poods.

The number of wells operated in the Baku district in January was 1,442; February, 1,494; and March, 1,480. Wells in drilling, which totaled 98 on January 1, reached 149 in February and 169 in March. By April 1 113 percussion rigs and 43 rotary rigs were in operation. Appreciable increase in production due to completion of new drilling operations is predicted to start in June. The approximate footage drilled was 11,039 in January, 12,495 in February, and 13,720 in March, a total of 37,254 for the quarter, as compared with 21,546 for the preceding months. The total shipments for the quarter reached 9,723,000 poods. Stocks at Baku were reported as 84,079,000 poods on April 1.

In the Grozny fields the number of wells operated was 202 in January (including 5 gushers), 211 in February, and 219 in March. In spite of the increase of wells in operation, production of pumped oil decreased owing to the fact, apparently, that operations were renewed on old wells having little productive capacity, while there was a falling off in gusher production. Wells drilling numbered 23 in January, 27 in February, and 31 in March. The footage drilled was approximately 1,813 in January, 2,380 in February, and 2,569 in March. There were piped and shipped via Grozny and Petrovsk 5,928,000 poods in January and 3,443,000 in February. Stocks on March 1 were reported to be 16,041,000 poods.

Drilling Equipment for Australia Bought Here

Early in March, Dr. Milsom, general manager for the Lander Oil Field, Ltd., the holders of oil prospecting leases at Orallo, in the Roma district, left Australia for California, armed with all data that had been gathered concerning those leases, in order to submit them to oil experts in the United States. He has advised from Los Angeles that those whom he has seen share his views and that he has purchased a rotary drilling plant costing about £12,000, which is expected to reach Brisbane in July. Before leaving Queensland Dr. Milsom selected what he considered the most suitable site for the first bore at Orallo, which selection has also been endorsed by the American geologists.

More Oil Companies Named in Fraud Orders

Ten more alleged oil companies involved in the so-called "merger" plan of obtaining money from unwary investors through stock-selling schemes have been named in the third of a series of fraud orders issued by Postmaster General New as a part of a campaign to protect the public from unscrupulous promoters. The ten companies, operating from Forth Worth, Tex., were all subsidiaries of the Revere Oil Co., which, however, was not itself included in the fraud order, as it is now in the hands of a receiver appointed by the U. S. District Court of Fort Worth, and remittances received from investors for stock are being returned. The Dixie Royalty Co., one of the Revere subsidiaries, also is in the hands of a receiver and was excluded from the order.

The companies named in the fraud order include the Kosse Gusher Syndicate; Kosse Gusher Syndicate No. 1; Kosse Gusher Syndicate No. 2; Kosse Gusher Lease Pool, G. N. Nicolson, trustee; Roco-Moran Syndicate; Moran Syndicate; Mayflower Oil Co., F. M. Grose, trustee; Guaranty Lease & Royalty Co.; International Brokerage Co., and the Eastern Trust & Mortgage Co., all of Forth Worth.

The Revere Oil Co., the principal respondent in the case, was organized, according to the evidence, by Warren H. Hollister, John C. Verser, and Albert H. Shepherd in September, 1920, with an authorized capital stock of $500,000, divided into 50,000 shares of the par value of $10 each. In March, 1921, the capital stock was increased to one million shares of the par value of $1 each. Shortly afterward the promoters entered upon the so-called "merger" plan of operation, which has resulted to date in the "merging" of over 100 defunct and dying oil concerns.

Each "merger" resulted in the acquisition by the promoters of additional lists of stockholders who were advised of the "merger" in extravagantly phrased circular letters and promised safety from loss on their investment in the old company if they would exchange their stock, dollar for dollar, for stock in the Revere company, with the stipulation that they purchase new stock equal to 25 per cent of their holdings in the "merged" company. These letters, virtually identical and purporting to come from officers of the "merged" companies, but in reality prepared by the promoters of the Revere company, were sent to stockholders of more than 100 "merged" companies. Of the many companies taken over the properties and assets of only three were actually merged. In three transactions none of the assets were acquired and in one other only some office furniture and fixtures were obtained.

USEFUL OPERATING IDEAS

Installing Pipe Lines in Shaft at Rosiclare Mine

BY E. C. REEDER

In the fluorspar district of southern Illinois the largest mine is on the bank of the Ohio River, and its extensive workings have been flooded twice within the last ten years by high water from the river. The limestone formations of the country in which the veins occur contain a good many water-courses or underground streams, which are often cut by the mine workings. Some of these have been known to flow at a rate of 1,000 gal. per minute for a few weeks and then settle down to a steady flow of about half of the initial rate. Seasonal fluctuations are noticeable. A method of installing heavy pipe lines in the main shaft of the Rosiclare mine is described here.

In January, 1920, the north drift on the 520 level cut a water-course. There was a rush of sand, mud, and water that carried everything before it and filled the drift with sand and mud 4 ft. deep for 1,000 ft. from the face. The flow of water was about 600 gal. per minute, and as no such quantity of water was expected, there were no pumps or pipe lines to this level that were at all adequate.

There were two No. 12 (18x9x20 in.) Cameron steam station pumps on this level. One was connected to a 5-in. line to the surface and the other pumped to a large pump on the 420 level. The only steam line available was a 3-in. line in bad condition. A larger pump was purchased and installed as quickly as possible, this being a used Prescott (10x15½x26x8¼x24) triple expansion, direct-acting, condensing pump. It was connected to the 5-in. line and started work early in April.

It was evident before this pump was installed that larger pipe lines must be put in at once, and how to get them into the pipe compartment of the shaft, which was only 3 ft. 2 in. by 5 ft. 5 in., and at the same time keep all the pumps in operation, was a problem. The pipe compartment of the shaft was filled with an assortment of pipes of different sizes and ages, including an 8-in. water column from the 420 level pump, a 5-in. water column from the 520 level pump, two 3-in. steam lines, one 4-in. air line, and a new 5-in. steam line which was incomplete, besides odds and ends of smaller pipe, electric conduits, and some ladders. Some of the pipe had been there for thirty years, and the newer lines were crisscrossed, bent, and elbowed around to pass through wherever there was an opening. It was impossible to get any more pipes in the compartment; and it was necessary to get an 8-in. column to the 520 level pump as well as to complete the 5-in. steam line so that it could be used for the pumps.

The pipe-line layout shown in Fig. 1 was eventually worked out. This allowed the installation of all the needed lines in the space available, with room for a future water column should it be needed. To accomplish this it was necessary to support the pipe lines in a different manner from the conventional method of using wooden clamps resting on cross-timbers, as the lack of space forbade. Fig. 1 indicates the brackets and clamps which support the pipe lines. The idea of carrying the steam lines on a bracket was borrowed from the Michigan iron mines, and with some changes the design of the heavy clamp bracket for the large water lines was worked out.

The next part of the problem was how to install the new lines and at the same time keep the pumps running. The procedure followed was to remove the skip box of the west skip and put a cast-iron counterweight on the skip frame (the shaft had two skipways hoisting in balance). This gave room enough in the corners of this compartment for a temporary 8-in. water column and a temporary 4-in. steam line which were run to the 520 level. The 8-in. line was connected to the 520 level pump, and the 4-in. line furnished steam to both the 420 level and 520 level pumps. This released both 3-in. steam lines and the 5-in. water column, and the work was begun in the pipe compartment by stripping out all the lines not in use. All this work had to be done at night, as the shaft was used for hoisting ore during the day. A small hoist was placed on the surface for hoisting and lowering pipes.

Tearing out the old pipe lines proceeded rapidly, and within two weeks the work of setting new timbers for bearers for the brackets was begun. Steel piano-wire plumb lines located at the centers of the 8-in. lines were hung from the surface to the lowest level, and the 8-in. brackets were bolted on all the way up the shaft ready for the water column for the 520 level pump.

The pipe was bolted together at the collar of the shaft, four lengths usually being lowered at a trip, and the 520 level pump line was lowered and coupled up in two days. This pump was then connected to the new water column, and the 420 level pump was connected to the temporary water column in the skipway. This released the 8-in. water column from the 420 level pump, which was then overhauled, moved and reset in its new location alongside the 520 level pump column.

The new 5-in. steam line was then put down and connected to the 420 level and 520 level pumps, and the 4-in. temporary steam line in the skipway was released for use as a temporary air line. The old air line was pulled out and the 5-in. water column, which had been overhauled, was put into place and connected up for a permanent air line. One 3-in. steam line was now lowered into place and connected to both pumps for use in emergency. The 8-in. and 4-in. temporary lines in the skipway now being released were pulled out and the skip-box was replaced.

The replacing of the electric conduits and the ladders were soon finished and the job was complete after a little over two months' work and at a cost of about $6,000. The gang usually consisted of four shaftmen, one hoistman, and a cager.

It is now nearly three years since the work was done and it has given satisfaction in operation. The steam

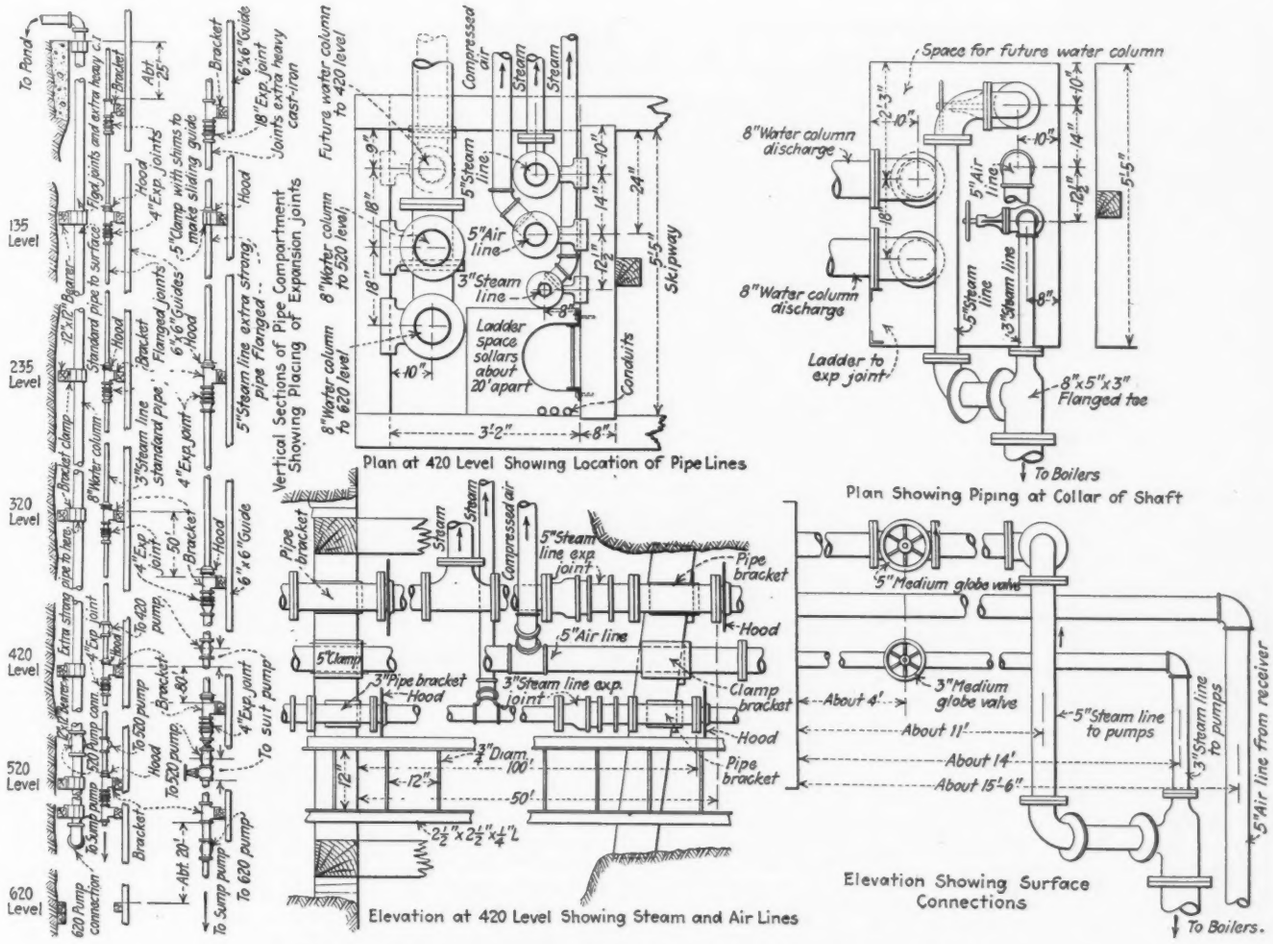


Fig. 1—Pipe-line lay-out designed for Rosiclare fluorspar mine

lines were covered with 85 per cent magnesia covering 1½ in. thick, protected by asphalt roofing wrapped and wired around it, which was put on under contract by the Johns-Manville Co. The expansion joints in the steam lines require little attention, and the water lines practically none. The new air line was so much tighter than the old that there was a reduction of about 30 per cent in the quantity of air compressed. Naturally the losses in the steam lines were cut down materially, and a saving of about 10 tons of coal per day over the old conditions resulted, so that the entire cost of installation was soon wiped out.

Modified Method of Testing for Silver in Barren Solutions

BY FRED C. BOND

The barren solution from the precipitate presses of the New York & Honduras Rosario Mining Co.'s plant is tested every hour for silver with an alkaline solution of sodium sulphide, for it is important to keep this solution as poor in silver as possible without the addition of an unnecessary excess of zinc dust. The sodium sulphide causes the precipitation of both zinc and silver sulphides, and the zinc sulphide masks the brown coloration caused by the silver sulphide until the silver in the solution amounts to about 0.25 oz. per ton. The test, therefore, is not sensitive enough, and sensitiveness is essential where the value of the refinery heads solution is subject to marked variations at times.

It was desirable to modify the method so that a brown coloration would become visible when the barren solution assayed 0.05 oz. per ton. Between 0.25 and 0.30 oz. the coloration is distinct; therefore if silver is added to the barren solution in amount sufficient to bring the assay value of the resulting volume of solution up to 0.20 oz. silver (supposing the barren solution to be free from silver), then the moment that the assay value of the barren solution itself increased to 0.05 oz. a brown coloration would become visible.

A testing solution was prepared accordingly; it consisted of a calculated weight of c. p. silver nitrate crystals dissolved in a measured volume of sodium cyanide solution to which had been added also a calculated amount of zinc sulphate. The zinc sulphate addition was made, as without it the test became too sensitive, owing to the diminution in the proportion of zinc sulphide precipitate to volume of solution. As the sensitiveness depends on the amount of zinc sulphide present in the test, the amount of silver to be added depends on the amount of zinc sulphate added. Experimental work will soon show the amounts of each salt that should be added to give a reaction of the desired sensitiveness.

The test, as it is at present conducted, consists in first adding 50 c.c. of special test solution of known silver content to 25 c.c. of barren solution, and then adding the sodium sulphide in solution. The sensitiveness has thus been made markedly greater, so that the ordinary operator can easily detect 0.08 oz. silver per ton of solution. This modified method was developed by H. J. Mainell.

Technical Papers

Chinese Mining and Metallurgy—W. F. Collins, Honorary Secretary of the China Institution of Mining and Metallurgy, 13, K'Uei Chia Ch'Ang, Peking, China, has sent us a booklet containing the constitution and bylaws of the Institution, printed in English and Chinese, and copies of three papers read at a meeting held on May 7. One is a brief description (pp. 6) of conditions in the Zeya Central Mining Area of Eastern Siberia. Another paper (11 pages in English) describes "Lead Smelting at the Hunan Government Smelting Works, Changsha, Hunan," and the third (32 pages in English) discusses "The Saltpeter Industry in China." The word saltpeter refers to nitrate of potash. The author says the industry dates from the earliest times in China and "present manufacture stands identical with that of olden days. People continue to manufacture in the same crude way as before and have not been able to realize the importance of the industry. They pay no attention to the efficiency of their methods and to the purity of their products."

Colloids — The National Research Council has recently issued a Colloid Bibliography in mimeographed form. This edition is preliminary to a more comprehensive one, yet it is a book of 135 pages, containing 1,800 references on 106 topics. All the references are classified, and many are accompanied by a brief comment as an aid in deciding on their relative importance. The book may be purchased from the Washington office at $1.

Copper Refining—The June *Bulletin* of the Canadian Institute of Mining and Metallurgy (603 Drummond Building, Montreal; price, 50c.) contains a 46-page article describing very completely the electrolytic refining process carried out at the Chrome, N. J., plant of the United States Metals Refining Co.

Geology at Oatman, Ariz.—Bulletin 743 of the U. S. Geological Survey, Washington, D. C., pp. 58, illustrated, obtainable from the Survey on request, is a preliminary report of the geology of the Oatman gold district, by F. L. Ransome. No attempt is made to describe individual mines and prospects, the report being issued to meet the demand for information on the geology of the district owing to the recent activity there. "In conclusion . . . the Oatman district does not hold out inducements for extensive exploration at depths greater than about 1,500 ft. . . . That additional orebodies remain to be discovered at moderate depths is probable. The district . . . presents some rather unusual difficulties to prospecting of the ordinary kind, as some of the largest orebodies thus far discovered gave little or no indication of their presence at or near the surface."

Pneumatic Conveying—*Chemical and Metallurgical Engineering*, New York City; price, 25c.) for May 28 contained an illustrated seven-page article "Route Your Material Via Air Line," which describes the various systems of pneumatic conveying that are in successful use. Conveying by this method, chiefly using one of the vacuum systems, has been adopted widely recently, and there are no doubt many places where it could supersede more laborious and expensive systems.

Metal Statistics—The American Bureau of Metal Statistics, 115 Broadway, New York City, has issued the third annual issue of its yearbook, for 1922, containing United States and world statistics for the copper, lead, zinc, gold and silver industries. (Price, $2.) It covers production, consumption, and commercial movements, and shows an enlarged scope over previous editions. Further, it is carefully compiled, the information is intelligently and attractively presented, and it is more up to date than any similar compilation.

Powdered Coal—Tests conducted by the U. S. Bureau of Mines and the Combustion Engineering Corporation on boilers fired with pulverized coal are reviewed in *Reports of Investigations*, Serial No. 2,470, obtainable on request from the U. S. Bureau of Mines, Washington, D. C. The tests showed that coal when powdered may be burned with greater thermal efficiency for steam raising than when burned by any other method.

Mine Directory—The Northwest Mining Association, Spokane, Wash., has issued a 64-page booklet devoted to the mining resources of the Pacific Northwest, and giving a directory of the mining companies in Idaho, Montana, Oregon, Washington, and British Columbia, together with their addresses and the names of their presidents. Various other information concerning the mining industry of that district is also given.

Truck-Operating Costs—Bulletin No. 10 of the Engineering Experiment Station, Lafayette, Ind., pp. 42, is an analysis of truck-operating costs which will be found of interest to all owners of motor trucks. It is obtainable on request.

Ontario Geology — Part VI of the Thirty-first Annual Report of the Ontario Department of Mines, Toronto, pp. 26, discusses the geology and minerals of the county of Leeds, a map of the county also being included. The county has been a producer of mica, phosphate, feldspar, and iron ore. The bulletin is obtainable free.

Hydro-electric Power in California—Water-Supply Paper 493 is a voluminous book of 1,276 pages, with numerous plates and maps, describing the hydroelectric power systems of California and their extensions into Oregon and Nevada. It may be obtained free from the U. S. Geological Survey, Washington, D. C., as long as the limited edition lasts, and thereafter from the Superintendent of Documents, Washington, D. C., for $2.25.

Underground Ventilation — "The Physiological Effect of High Temperatures and Humidities With and Without Air Movement" is discussed in a seven-page paper recently issued by the U. S. Bureau of Mines, Washington, D. C., as *Reports of Investigations*, Serial No. 2,464, obtainable on request. The paper deals with the effect on body temperature and pulse rate in still air compared with moving air of temperatures from 90 to 100 deg., and 100 per cent relative humidity, the subjects being at rest.

Oil-Bearing Sands—Bulletin 751-A of the U. S. Geological Survey, Washington, D. C., pp. 22, illustrated, obtainable on request, discusses the "Continuity of Some Oil-bearing Sands of Colorado and Wyoming." Special attention was given to the determination of the stratigraphic position of the oil-bearing sands, to the characteristics necessary for their recognition, and to the correlation of these sands along the foothills from Colorado Springs, Colo., to the Big Horn Basin, Wyo.

Arkansas Diamonds—Bulletin 735-I of the U. S. Geological Survey, Washington, D. C., pp. 43, obtainable on request to the Survey, discusses the "Diamond-Bearing Peridotite in Pike County, Arkansas." The report consists mainly of a presentation of the available information on the diamond-bearing area and a comparison of it with the South African diamond fields. No information is given regarding recovery of diamonds per unit of material treated, and there seems to have been some aversion on the part of operating companies to allow examination of their properties. A bibliography is included.

Australian Mining and Metallurgy—The *Proceedings* of the Australasian Institute of Mining and Metallurgy, No. 47, Sept. 30, 1922, pp. 310, has recently been received from the Institute, Melbourne. The price is not stated. Many interesting papers are included. There is a series of very complete articles on the lead-smelting practice of the Port Pirie Works of the Broken Hill Associated Smelters Proprietary, Ltd., covering about 200 pages; and shorter articles on "A Mechanical Disintegrator for Slime Samples," "Notes on the Estimation of Tungsten in Ores," Methods and Apparatus for the Determination of Dust Suspended in Air," and "Volumetric Determination of Iron: New Method of Reduction."

Mica in Madagascar—*Bulletin des Mines de Madagascar*, No. 3, for March, contains a 10-page paper on the mica industry in that French dependency. The yearly subscription price to the monthly bulletin is 6 fr., from the Imprimerie Officielle, Tananarive, Madagascar.

Quarry Transportation — The latest paper in the series being written by Oliver Bowles on lime-plant problems takes up the matter of transportation, with a discussion of tracks, cars, and haulage. It may be obtained free from the U. S. Bureau of Mines by requesting *Reports of Investigations*, Serial No. 2,454.

SOCIETIES, ADDRESSES, AND REPORTS

Mining Congress Meets in San Francisco

Resolutions Adopted Express Sentiment of Operators Regarding Silver Situation, "Blue-Sky" Legislation, Immigration and Other Matters

AT A MEETING of the governors of the Western Division of the American Mining Congress, held in San Francisco, June 11 and 12, 1923, nine resolutions were adopted to be submitted to the American Mining Congress, as a whole:

Resolution No. 1 was an emphatic reiteration of protests against paternalism and government interference in private business, incidentally pointing out "the alarming increase of taxation in every branch of industry and the serious hampering of legitimate business by pernicious legislation" as reasons for simplification of government upon the principle of home rule and local self-government.

Resolution No. 2, interpreting the Pittman Act, read:

"Whereas, the legality and propriety of the action of the Department of the Treasury in revoking allotments of silver for subsidiary coinage provided for by the Pittman Act have been seriously questioned by silver producers of the West, Now, therefore, be it,

Resolved, That the Western Division of the American Mining Congress record the opinion that the matter rests upon judicial interpretation of the Pittman Act and upon that alone. It therefore urges that the executive officers of the American Mining Congress, in conjunction with the producers of western states, immediately take such steps as may be necessary to bring the matter before the proper courts for disinterested consideration and judicial action, to the end that a situation which has caused producers to question the good faith of the government may be clarified and that silver producers receive, fully and exactly, the benefits provided under the act, regardless of the action of a department that is wrongfully endeavoring through widespread propaganda to deceive the people into believing that producers seek an unfair interpretation of the act."

Resolution No. 3, recommending a conference of silver producers of the western hemisphere, read:

"Whereas the United States, Canada, Mexico, Bolivia, Peru, Chile, Brazil, Colombia, Ecuador, Argentine and other countries of South and Central America produce approximately 85 per cent of all the silver of the world; and,

"Whereas the daily price of silver is established by Great Britain, from whose territory but a small fraction of the world's production is annually produced, Now, therefore, be it resolved,

"That the Western Division of the American Mining Congress respectfully suggests to the Senate Gold and Silver Inquiry Commission, now deliberating at Washington, D. C., that steps be immediately taken to provide for a conference of representatives from every silver-producing country of the Western Hemisphere for the purpose of considering ways and means to extend the uses of silver for monetary and other purposes throughout the world and to restore the control of the market price of the metal to the producers; And be it further,

Resolved that in the opinion of the Western Division the conference should be held at the invitation of this nation, to the end that the representation may be thoroughly expressive of the collective desires of those who are most vitally interested in the future of the metal."

In Resolution No. 4 the Western Division went on record as in favor of "selective immigration, operative prior to embarkation, or such other procedure, if a better be proposed, as will tend to increase the proportion of workers among aliens admitted to the United States."

Condemnation of efforts to sow discord and create dissension between labor and capital was voiced in Resolution No. 5.

Alleging that "blue-sky" legislation was in large part to blame for an "alarming decrease" in metal production in the western states as compared with that of the pre-war period, the Western Division advised the executive officers of the Mining Congress, in Resolution No. 6, that it was "the sentiment of mining interests of the West that a concerted effort be made to bring about modification and uniformity of such 'blue-sky' laws, to the end that, while every possible protection be given to the careful investor, encouragement be also offered to the prospector and small operator to raise capital for initial development of mineral resources." The resolution continued:

"Be it further resolved, that, as the first step to that end, this division heartily indorses the effort now being made in the four northwestern states of Washington, Montana, Idaho, and Oregon to secure the appointment of a commission by the governors of those states to study the entire question in its relation to the development of latent resources in the hope that a sane, constructive law may be evolved for the consideration and possible adoption of the several legislatures; and be it further

Resolved, That we commend this plan to governors of all western states in the hope that their co-operation may be enlisted in an effort to remove the suggestion of dishonesty placed upon all speculative enterprises by laws that have substituted government by individuals or commissions for government by law and which are gradually but surely bringing stagnation to the mining industry; and be it further

Resolved, that this division is unalterably opposed to any effort to fortify state 'blue-sky' laws by similar federal legislation and especially and emphatically condemns the intent and purpose of such measures as the Denison 'blue-sky' bill, which failed of passage at the last Congress, but which it is anticipated will be reintroduced at the next session."

In Resolution No. 7 the attention of the President of the United States was invited to the effects in Alaska of "government from afar" and the suggestion was made that his observations during the forthcoming trip to the territory be directed to study of the situation.

In Resolution No. 8 an invitation was extended to the mining interests of Alaska to become actively identified with the organization by appointing a member of the board of governors.

In another resolution, No. 9, closer co-operation among all of the various metal mining organizations throughout the West was urged as the most effective manner in which this most desirable result may be accomplished.

The following were present at the meeting: Edwin Higgins, San Francisco; George Stahl, Denver, Colo.; R. Macbeth, Mackay, Idaho; Sidney Norman, Spokane, Wash.; A. G. Mackenzie, Salt Lake, Utah; M. B. Tomblin, Denver, Colo.; and J. E. Callbreath, Jr., Washington, D. C.

B. C. Prospectors' Association Meets in Nelson

The annual meeting of the British Columbia Prospectors' Association, held in Nelson, June 6, recorded vigorous protest against the proposed increase in taxation of crown-granted mineral lands.

Officers elected at the meeting for the ensuing year were J. Mulholland, president; C. Woodrow, vice-president; R. G. Joy, secretary; and R. J. Elliott, treasurer.

Students Visit Plants

On June 2, fifty students in mining and petroleum engineering in the School of Mines of the University of Pittsburgh completed a circle tour of Pennsylvania and New York. The purpose of the trip was to give the students an opportunity to study structural and stratigraphic features, to collect rock and mineral speciments, and to visit the various mines and quarries en route.

MEN YOU SHOULD KNOW ABOUT

Robert George Hall, of San Francisco, is in New York.

W. W. Mein has returned to San Francisco from New York.

C. N. Loeb, president of the American Metal Co., has returned from Europe.

C. A. Mette is in Arizona on professional business with the Ray Hercules company.

Oscar Hershey, of the San Francisco firm of Burch, Hershey & White, has been in Reno.

Frank G. Willis has returned to Baxter Springs, Kan., after an extended trip examining mines in Socorro County, N. M.

Jack Foran, mining engineer, spent ten days recently in the Fairbanks district, Alaska, investigating a dredging project.

I. H. Cornell, vice-president and sales manager of the St. Joseph Lead Co., left New York on May 21 for a trip through the West.

N. L. Wimmler, placer mining engineer for the Bureau of Mines, recently reached Fairbanks to begin field work for the season.

Thomas B. Stearns, of Denver, Colo., has been taking a holiday at Santa Barbara, Calif., and passed through San Francisco on his return to Denver.

Charles Henry White, who has been in Cananea, Sonora, Mexico, since last December, has gone to Nacozari, Mexico, on mine-examination work.

C. A. Hartnagel and his staff, of the New York State Geological Survey, is continuing studies and operations in the petroleum field of southwestern New York.

S. R. Mitchell, consulting metallurgist of Melbourne, Australia, passed through San Francisco on his return home, after a visit of several months in the United States.

Julius Loeb, sales manager of the American Metal Co., and **S. Sussman,** also of the sales department of that company, will sail for Europe on the "Reliance" on June 26.

George A. Guess, of Toronto, has returned from South America, where he made a successful blast-furnace test with pyritic smelting with anthracite at a high altitude.

Edward D. Durham has accepted the position of engineer at the Mammoth plant of the U. S. Smelting, Refining & Mining Co., at Kennett, Shasta County, Calif.

William Sloan, British Columbia Minister of Mines, is back from the Northwest Mining Convention and a tour of the eastern districts of the province.

Earl Belding, until recently foreman of the Tonopah Belmont mine, in Tonopah, has been appointed superintendent of the Belmont-Wagner mine, at Telluride, Colo.

Dean R. W. Brock of the University of British Columbia announces that the Geological Department of the University has been commissioned to make a geological survey of the colony of Hongkong, China.

W. G. Swart, vice-president and general manager of the Mesabi Iron Co., Babbitt, Minn., accompanied by **Fred Jordan,** general superintendent of the same company, is on a business trip to points in the East.

Arthur L. Walker, professor of metallurgy, Columbia University, sailed on June 14 for South America, where he

Professor Arthur L. Walker

will visit the principal mining properties. Later he will go to Spain, Portugal, Italy, and Cairo.

William H. Pierce was recently elected vice-president of the American Smelting & Refining Co., and placed in charge of refinery operations of the Baltimore, Perth Amboy and Omaha plants.

Frank M. Smith, director of the Bunker Hill smelter, has recently returned from San Francisco, where a new plant will be erected to handle the product of the Northwest Lead Co. for the California district.

William A. Grieves, secretary of the Jeffrey Manufacturing Co., of Columbus, Ohio, addressed the members of the San Francisco Engineers' Club, June 11, 1923, on the subject of industrial relations and welfare.

J. T. Grayson has opened an office at Room 950, Pacific Building, San Francisco, Calif., under the firm name of Grayson & Tucker. A general consulting business in mining and civil engineering will be conducted.

F. L. Ransome, whose acceptance of a professorship of geology at the University of Arizona was recently announced from Tucson, retains connection with the U. S. Geological Survey and is not under engagement to remain permanently at the university.

Edward H. Orser, consulting mining engineer and geologist, Kirkland Lake, Ontario, has been appointed consulting engineer for the Ontario National Development Corporation, Ltd., and has completed an extensive investigation of the property of the Porcupine Grande Gold Mines, Ltd.

James J. Martin, formerly in charge of the dredging operations of the Chicksan Mining Co. in Korea, left San Francisco on June 2 to undertake prospecting and development work on the west coast of Colombia for the American Gold Dredging Co. **Ralph Gruber,** of Marysville, Calif., is leaving to join Mr. Martin in the near future.

Milnor Roberts, Dean of the College of Mines, University of Washington, Seattle, visited Bozeman, Mont., on June 12 to attend the dedication of the new engineering hall erected by the State University at its State College. The hall is named for the late William Milnor Roberts, the father of Milnor Roberts, to commemorate his services to the State of Montana.

H. S. Mulliken, Chief of Division, War Mineral Supply, Bureau of Mines, Interior Department, Washington, D. C. sailed today for South America, where he will join Dr. Bain, Director of the Bureau, in the investigation of the Chilean nitrate situation, which they are to make at the request of the Department of Commerce, the Secretary of the Interior having loaned their services to the Commerce Department for this purpose.

OBITUARY

W. A. Pritchard, consulting engineer of the Oroville Dredging Co., died recently in London from heart failure. He was a member of the I.M.M. and the A.I.M.E.

Richard J. Chapman died at Virginia City, Nev. on June 4, 1923. For many years Mr. Chapman was general mine superintendent for the Golden Mining Co. in the Black Hills of South Dakota.

Paul Hilsdale, superintendent of the Grand Central and Gemini mines of the Chief Consolidated Mining Co. at Eureka, Utah, met his death in a cage accident at the Gemini mine on the morning of June 12. **James Hanley,** foreman, who was riding with Mr. Hilsdale at the time, was so severely injured in the accident that he died the following night.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

SENATOR PITTMAN has encouraging news for the silver-mining companies. Enthusiastic support and co-operation is promised for the meeting of producers to be held in Reno, Nev., later in the summer. Big companies see bright possibilities in concerted action.

The Oliver Iron Mining Co. is improving change houses and other buildings for employees on Gogebic Range.

Charles M. Schwab interests have gained control of several additional zinc mines in Oklahoma.

Shipments of iron ore have been resumed from the famous Iron Mountain mine in Missouri—the first in twenty-three years.

The "dissenters" among Dome Mines shareholders were a small minority at the annual meeting.

Two gold-dredging enterprises are launched in Arizona.

The American Smelting & Refining Co. has declared a dividend of $1.25 per share on common stock; it is the first for two years.

The Cynide Mining Co. is completing the erection of a new mill in Idaho.

Output at the Florence mine, in British Columbia, will be largely increased.

Grass Valley mine operators raise wages 50c. in California.

Iron Mountain Mine, Long Idle, Again Produces

Chicago Lawyer Turns Stock Farm Into Iron-Ore Enterprise—Once Supplied Andrew Carnegie's Plants

After lying idle for twenty-three years, the once famous Iron Mountain mine, in Missouri, has begun shipments of ore to the plant of the St. Louis Coke & Iron Co., at Granite City, Ill. Production at the start will be at the rate of 1,000 tons per day. This may be increased to 2,000 or more.

Mining engineers and scientists in 1890 sounded taps on Iron Mountain. After careful investigation they asserted that its ore deposits, famed for their purity, had become exhausted. The old Iron Mountain Co. sold the property in 1893, believing that the mine was worked out. The price received is said to have been $100,000.

A few years ago Leonard A. Busby, attorney and president of the Chicago Surface Lines, purchased the 15,000 acre tract as a stock farm. He had no idea at that time of reopening the mine. He wanted it as a country estate and stock farm, and is said to have paid about $400,000 for the property.

The second discovery of ore is credited to William T. May, a mining engineer with experience on the Rand. Following the close of the World War he examined the deposit and decided that the mining experts and scientists were wrong. He convinced Busby, and since then about $1,000,000 has been spent on improvements, digging shafts, and installing modern mining machinery. Ore reserves are said to total more than 20,000,000 tons.

The recovery of Iron Mountain once more makes the St. Louis district a factor in the iron and steel industry. The combination of this iron deposit with the fact that a way has been found to coke southern Illinois coal gives the St. Louis district an advantage in producing pig-iron and steel products. The central location of the city is also in its favor in competing with other steel centers.

Fifty years ago Iron Mountain was always reckoned with in the iron and steel business. Andrew Carnegie used ore from this mine in his first furnaces in the Pittsburgh district, and the first steel plant opened in the Chicago district was located at Joliet, Ill., instead of Chicago, because Joliet was closer to Iron Mountain.

"Cynide" Cyanide Plant, in Idaho, Nears Completion

Construction of the mill of the Cynide Mining Co. 26 miles east of Bonners Ferry, in Idaho, is nearing completion; $60,000 worth of cyanide tanks, thickening, grinding, and electrical equipment has been ordered and is being installed. The grinding installation will be finished in ten days. The hydro-electric plant designed to furnish 670 hp., situated on the Moyie River, 10 miles from the mine, is half completed and will be rushed to supply power when the mill is completed. Underground development has revealed a new vein of gold ore running $30 per ton, according to J. B. Ellis, president. Approximately 105,000 tons of ore has been blocked out in the Buckhorn mine and is available for milling.

Gold-Dredging Operations in Arizona Financed

One on Hassayampa River, Other at Greaterville—Water Problem Solved by Sinking Wells

Two placer projects are reported to be successfully financed in Arizona, and the owners are planning the erection of dredges in the near future. About six quarter sections of ground, located on the Hassayampa River, about 50 miles northwest of Phoenix, have been drilled and are said to contain values of from 10c. to $3.25 per yard. It was in this area that the first placer gold of Arizona was discovered and for many years miners have washed the sands of this river and the Santa Domingo, a tributary wash. Many rich gold-bearing veins have been worked in the district above, and it is believed that these are the source of the placer gold. It is reported that a California dredging company is preparing to start operations on this ground.

Horace J. West, president of the Greaterville Gold Dredging Co., claims to have successfully financed the purchase of a dredge that will be put in operation on his company's property, which is located at Greaterville, about 40 miles from Tucson. The company owns a 2,000-acre tract in this area that contains, besides gold, a black sand that can be used for the making of sponge iron. The greatest obstacle to the working of this placer has been the scarcity of water, but the company has completed a series of wells that are producing an adequate supply. It is expected that the erection of the dredge will be started by Sept. 1.

Mine Activity in Durango, Mexico, Shows Definite Increase

Dumps and Abandoned Orebodies Will Be Worked—Otaez Ships High-Grade Lead-Silver Ore

In spite of the recent falling off in prices of metals, mining in the vicinity of Durango, Mexico, is on the increase. The old Vacas mine dumps, containing several hundred thousand tons of silver-lead-zinc tailing, are to be worked, and new machinery has been added to the old plant. These mines were closed down in 1906, but since that time a railroad has been built close to the property, and engineers believe that the old dumps can now be worked at a good profit by modern methods.

The Promontorio mines, near Chincates, owned by Max Damm, are being examined by engineers. This is a silver-lead property that has shipped a great deal of silver ore, and it is claimed that there is much low-grade silver ore in sight which can be concentrated. It is said that the property requires a further investment for purchasing machinery in order to make it more profitable, although shipments at present are several cars each month.

The Eureka, Melchor Ocampo y Anexas, at Tejamen, has again begun operations and is shipping concentrates.

The Otaez Mining Co., which is working the Esperanza mine, is ready to ship its fourth car of high-grade ores running over 200 oz. silver and 40 per cent lead. These ores are taken from development work only, as the shaft is being deepened to connect with a tunnel 300 ft. below. When the connection is made with the tunnel, mining can be carried on, and the bodies of ore above the tunnel handled cheaply by gravity. The mine will also be drained through the tunnel if water is encountered.

The Guanacevi district is sending out little ore, but well-financed interests have had engineers on the ground for some months examining promising properties. Though this camp has large quantities of low-grade ore, large capital and co-operation of the owners are required to make it a profitable camp. So far, the owners of mines have not shown the co-operative disposition necessary to make the camp a success.

The Conjuro mine, at Chalchihuites, continues regular shipments of smelting ores to the amount of 400 tons per month. This is one of the most active mines in the district.

At Sombrerete, Zacatecas, much exploration work is going on, and diamond drilling progresses on the extension of the Noria vein.

The Ruby Silver mine, at Huahuapan, in western Durango, is reported to have a carload of high-grade ore ready for shipment. This mine had not been worked for a number of years until recently, when it was bought by men from Dallas, Tex., who seem to be making a success of operations. Before the late revolution this property shipped rich silver ores. The mine now promises to become an important producer.

Joplin-Miami Operations Slacken as Prices Recede—Labor Scarce

There has been a distinct curtailment of production in the Joplin-Miami field during the past few weeks. Several important mines have closed down, including the Cosmos, Harrisburg, and Sante Fe. and numerous others have cut off night shifts. The Cosmos may be down permanently, but the others will be going again if ore prices improve. Cutting off night shifts has been the consequence of poorer ore prices, as well as of the increasing labor shortage. Men are going to the berry fields and wheat harvest, a movement which brings about a shortage in workers every year. Unless ore prices improve there is a possibility there will be a several weeks' shutdown during July or August.

Canadian Asbestos Plant Burns; Loss Estimated at $300,000

A dispatch from Sherbrooke, Que., dated June 16 says that damage estimated at over $300,000 resulted from a fire that broke out in the main mill of the Asbestos Corporation of Canada at Thetford mines the night before. The flames spread so rapidly the greater part of the plant soon was reduced to ashes. The report states that the fire resulted from an overheated bearing.

Russian Soviet Hopes To Revive Manganese Exports

According to a report published by the Mining Department of the Russian Soviet Government, the exports of manganese ores from Russia, which amounted before the outbreak of the war to 35,000,000 poods (one pood being equivalent to 36 lb.), or about 85 per cent of the world's demand, amounted in 1922 to 9,000,000 poods, thus being largely supplanted by Brazilian and Indian manganese ores, which two countries supplied nearly 25,000,000 poods. Though the Caucasian manganese ores are of the best quality and though the demand for manganese ores has largely increased on the world's markets on account of an increased production of steel, the price for Russian manganese ores, which up to the outbreak of the war was from 10 to 15 per cent higher than that of any other manganese ores, remained during the year 1923 from 4 to 5d. per pood below the price of the Brazilian and Indian products, and this in spite of the fact that freight rates from the Black Sea to London are 14 to 16s. per ton cheaper than those from Brazil and India. It is now intended to ship the Russian ores by the Russian Volunteer Fleet, which company has made special freight rates for these transports. The present bad situation of the Russian manganese ore export trade is chiefly attributed to the lack of the Soviet organization. It is now intended to combine the two government organizations for the export of manganese ores, the Tschemo (Caucasus) and the Buda (Charkow), which hitherto had separate agents abroad.

Bath Rooms for Miners Feature New Oliver Construction

Extensive Building Program on Gogebic Range in Michigan—Substantial Structures for Change Houses

The Oliver Iron Mining Co. is carrying on an extensive building program on the Gogebic Range this summer. At the Norrie-Aurora group of mines it will install another 5,000 kw. steam turbo-generator in the "G" Pabst power plant, bringing its capacity up to 15,000 kw. Another change at this plant will be made in the "dry," where some of the lockers are to be removed to make room for more sanitary facilities including twenty-four latrines and twenty-four shower baths in addition to the old equipment of this kind. At the "D" east Norrie change house similar facilities are to be installed, but an addition, 15 x 40 ft., to the building is to be constructed to take care of them. Both these buildings are of single-story brick-nugged frame construction covered with galvanized iron, and have accommodations for from 400 to 600 men. In the North Pabst vicinity fifty dwellings are to be modernized and will have completely equipped bath rooms with lavatory, tub, and closet added. At the Puritan mine the houses are all being wired for electric lights for the increased comfort of employees.

At the Geneva mine work is progressing on the new engine house, which is to be 46 x 142 ft., of masonry and concrete block construction with a steel frame and steel and concrete roof. The electrical apparatus, lightning arresters, transformers, and switches, and the cage hoist are to be installed this summer. The skip hoist and compressors are to come later. It is also expected that the shafthouse will be erected the coming fall, as will be that at No. 1 shaft of the Puritan mine, the steel for which is already on the ground. At the Puritan a set of ore pockets will also be erected.

In addition, at the Tilden mine, near Bessemer, the Oliver company is building a new change house to accommodate 200 men. It will be 28 x 92 ft., with concrete floor and walls of wood covered with sheet iron and plastered inside. It will be equipped with steel lockers and the wash trays will have spray heads like a shower bath instead of wash basins. This is a construction this company has used in other change houses built in the last few years; it has proved very satisfactory, as the men always have available a supply of clean running water.

Bathing requirements are taken care of by eight shower baths. In addition to the engine house at this mine has just been completed, and a new Worthington, duplex, two-stage air compressor installed. The latter is 20 x 12 x 16 in. and has a rated capacity of 1,200 cu.ft. per minute. The drive is by a short belt from a 200 hp. induction motor. The power for this and the other electrical equipment at the Tilden is purchased from the Lake Superior District Power Co.

Encouragement for the Silver Miner

Senator Pittman Talks on Situation—Readjustment of Purchases Possible—Anaconda Makes Generous Offer—Widespread Support of Producers' Association Assured

By Arthur B. Parsons
Assistant Editor

SILVER MINING COMPANIES will find the following items of news more agreeable than most that have come to them recently.

1. C. F. Kelley, president of the Anaconda Copper Mining Co., has authorized Senator Pittman to inform the Director of the Mint that his company is prepared to settle its Pittman Act silver sales on the basis of delivering miner's affidavits for 100 oz. of silver for every 95 oz. of bullion tendered to the government.

2. Senator Pittman declares that he still believes that the Director of the Mint will be compelled to change his ruling regarding the revocation of about 11,000,000 oz. of silver used for subsidiary coinage, thereby extending the period of $1 silver purchases.

3. And, most important of all, is the assurance that both Mr. Kelley and Mr. Brownell, of the A. S. & R. Co., are definitely committed to the opinion that the formation of some kind of association for the advantageous marketing of American silver warrants the most serious consideration. The attitude of both is changed from that of a month ago.

While most of his fellow statesmen are vacationing or junketing, Senator Pittman is putting in better-than-union hours on his campaign to help the silver producers. He wants to see that the government buys every ounce of silver that the law directs, and that the small producer is not discriminated against to the advantage of the big fellows. Then he wants to get the producers from Canada, the United States, Mexico and the other Latin-American countries to meet in Nevada late in the summer to discuss an export association of some kind. Last week he conferred with officials of the smelting companies in New York. Before returning to Washington he was good enough to tell me in detail of his work and his plans.

Taking up the three matters that I have mentioned in order: The official reports to the mint show that the A. S. & R. Co. has recovered in its metallurgical operations 99.6 per cent of the silver received at its smelting and refining plants during the period of Pittman Act purchases. The Anaconda company reports about 97.5 per cent, and the other large vendors (six companies have sold 90 per cent of the silver marketed under the act) show recoveries between these limits.

Senator Pittman was aware of the custom of paying the miner for 95 per cent of the silver contained in the ores sold to custom smelters, on the theory that this represented approximately the proportion of metal that was recovered, or, at least, that it was a safe average basis on which to settle for ores purchased. There appeared to be a wide discrepancy. At a hearing in Washington held on the last three days of May he sought an explanation from the smelter representatives. He learned that in 1920 one of the smaller companies, and early in 1921 all the others, altered their contracts so that the settlement sheets indicated payment for 100 per cent of the silver in the ore, instead of the usual 95 per cent; at the same time an additional treatment charge was imposed to exactly offset the payment for the additional 5 per cent of silver. So far as the miner was concerned he got neither more nor less for his ore that he had been getting before. At the same time this change in bookkeeping permitted the smelter to sell at the Pittman Act price, on his own account, whatever silver he recovered in excess of 95 per cent. This arrangement was made with the knowledge and approval of the Treasury officials. Naturally it was advantageous to the smelter to get a high recovery. The Senator then inquired into the method used to arrive at the percentage recovery. The figures in the right-hand column of the following table illustrate the method that is used—the only method that can be used:

	Actual Silver, Ounces	Estimated Silver, Ounces
1—Stock at plant in ore, by-products, and in process, January, 1920	1,125,000	1,000,000
2—Intake, January, 1920, to May, 1923	5,000,000	5,000,000
3—Total stock and intake	6,125,000	6,000,000
4—Sales of bullion	5,000,000	5,000,000
5—Stock at plant, May, 1923	875,000	980,000
6—Loss in slag unrecoverable fume, dust, etc., by difference	250,000	20,000
7—Metallurgical loss, per cent	5.0	0.4
8—Metallurgical recovery, per cent	95.0	99.6

Two elements in the calculation (items 1 and 5) represent estimates by the plant managers of the amount of silver at the beginning and end of any given period, contained in stocks of ore, in intermediate products at various stages of the process, in the flues, in accumulations of matte, brick, and miscellaneous byproducts. F. W. Hills, auditor for the A. S. & R. Co., explained at length the impossibility of making an accurate estimate. He said that frequently plant managers were detected in "fudging" (his own word) estimates between different plants. The figures in the left-hand column in the same table indicate hypothetical quantities that might be the actual, though undeterminable, quantities that are estimated as shown in the right-hand column. The purpose of the table is merely to show how the whole thing is predicted on estimates that are impossible of verification, except by immediate shutting down and cleaning up of the plant, an utterly impracticable proceeding.

The question arises, what disposition was made of the silver in ore assaying under 1 oz. per ton, for which the smelters do not ordinarily pay? Mr. Brownell declares that with the A. S. & R. these quantities are determined and treated as foreign silver in the metallurgical balance sheet, so that they do not serve to increase the apparent recovery. Presumably the same practice is followed by the other companies.

Senator Pittman is fully aware of the fact that metallurgical processes are much more efficient than they were; that lead smelting (from which the A. S. & R. gets most of its silver) generally recovers more silver than copper or zinc smelting, and that the A. S. & R. Co. buys a great deal of doré bullion on which the recovery is virtually 100 per cent.

However, his argument in favor of the 95 per cent settlement, if I understand him rightly, and making allowances for my translation of his polished diction into my own words, is this: "It is not incumbent on the government to prove that the silver you offer is not properly qualified. The burden of proof lies with you to prove to the satisfaction of the mint officials that it is qualified. You base your estimate of recovery on figures that no one but heaven can prove or disprove, and these results are several per cent higher than the figures on which you always have settled and still continue (in effect) to settle with the miner. You allocate your metallurgical loss between foreign and domestic ores in proportion to the amount of silver contained in each, so that if the estimates of recovery are high your silver is not properly purchaseable under the Pittman Act. It is up to you to prove conclusively that they are not high, and this, according to your own statements, is physically impossible. As an alternative you have the figure on which you settle with the miner, the figure which all but one of you used during the first eight months of the $1 purchases, the figure which no one, either official or miner, would question—95 per cent."

Mr. Kelley, of Anaconda, says that he has always urged this policy; he says that he is ready to waive any rights and settle on this basis now. Of course his company is a producer as well as a buyer of ore, and for that reason his situation is slightly different. I am not prepared to express any opinion as to what the other companies ought to do; but if they should agree to the 95 per cent basis, acceptances of about 6,000,000 oz. of silver would be voided, and this amount would remain to be replaced by mine production.

With respect to the controversy about the revocation of 11,000,000 oz. for subsidiary coinage I am not at liberty to divulge the most recent developments. The Senator's auditors are busy at the

Philadelphia mint and if the proof that he thinks exists can be obtained, the complexion of the whole matter will be changed. The whole question will then be thrashed out in hearings before the subcommittee of one: the Senator himself.

As soon as the end of this business is in sight a definite date will be set for the conference which all the silver producers in the western hemisphere will be urged to attend. This will probably be held at Reno, Nev. Although no invitations have been issued, the plan has been given publicity in the press and Senator Pittman has already received informal assurance from prominent men in the silver-mining industry of Ontario and British Columbia, in Canada, that they will be on hand.

As I stated, the hearty support of both Mr. Kelley and Mr. Brownell is assured. This is important for the reason that both these gentlemen, when the plan was first broached, were skeptical as to both the legality and the practicability of any plan for organizing for the ultimate purpose of creating and maintaining a better market for silver. Now they are prepared to have the legality of associating under the Webb-Pomerene Act put to the test. Perhaps supplemental legislation will be needed; in that event Senator Pittman is prepared to introduce and advocate any necessary bills.

One objection of Mr. Brownell's was that his company could not afford to carry or "speculate" on 3,000,000 oz. of silver per month. The solution of this difficulty must be an arrangement whereby the smelting companies will pay for silver in ore purchased with bullion, the holding of which in the hands of the association will have to be financed by the mining company that sold the ore. Another question that arises is the feasibility of involving foreign silver in transactions under the Webb act. That and other questions must be considered. That is the purpose of the proposed Reno meeting.

John Hays Hammond, between hearings of the President's Coal Commission, has found time to give the silver question careful consideration. He has expressed the opinion to Senator Pittman that the establishment of a silver association is a practicable and desirable project. Mr. Hammond is largely interested in silver mining in Mexico, and his influence will be a big help in carrying out the present plan.

Herbert Hoover, Secretary of Commerce, has written the Commission of Gold and Silver Inquiry stating that his department will compile, before the Reno meeting, statistics and information showing the currency status of silver in the principal countries of the world. It is expected that this report will show the exact amount of the decline in the use of silver for monetary purposes in the various countries and will set forth the reasons which led to such procedure.

The interest of the mining and smelting companies in a satisfactory silver market is vital; the interest of Canadian and Mexican producers is identical with that of miners in this country. If every one will go to Reno prepared with constructive ideas and a willingness to co-operate, the plans formed there may prove to be the foundation of steady prosperity for the silver-mining industry. And do not forget for a minute that a good silver market helps lead and zinc and copper mining.

Copper-Nickel-Cobalt Output Makes Up Decrease in Gold and Silver

Returns received by the Ontario Department of Mines from the metalliferous mines, smelters, and refining works of the province for the three months ending March 31, 1923, are tabulated below. For purposes of comparison the quantities and values are given for the corresponding period in 1922. Tons throughout are net tons of 2,000 lb.

Ontario's Metalliferous Production, First Quarter of 1923

Product	Quantity		Value	
	1923	1922	1923	1922
Silver, oz.	2,729,749	2,958,094	$1,792,876	$1,980,099
Gold, oz.	213,263	226,176	4,373,513	4,675,475
Platinum metals, oz.	20	.....	1,740	.....
Copper (metallic), lb.	2,872,540	22,553	460,441	1,310
(a) Copper in matte exported, tons	549	5	109,875	897
(a) Nickel in matte exported, tons	1,270	.....	507,836	.....
(b) Iron, pig, tons	.....	7,261	.....	178,530
Cobalt, metallic, lb.	84,639	21	205,459	75
Cobalt oxide, lb.	135,923	75,505	268,241	157,906
Nickel oxide, lb.	3,140,298	25	451,213	7
Nickel, metallic, lb.	4,761,768	522,184	927,406	129,055
Nickel-cobalt compounds, lb.	234,712	329,274	74,186	68,093
Lead, pig, lb.	1,003,633	638,989	69,067	35,875
Total	.....	.....	$9,241,853	$7,227,322

(a) Copper valued at 10 c. in matte form and nickel at 20 c. in 1923.
(b) Total output of pig iron was 102,515 tons, worth $2,745,605. Figures in the table represent proportional product from Ontario ore smelted.

Present Dome Management Endorsed at Meeting of Stockholders

While the annual meeting of Dome Mines, Ltd., of Ontario, was far from being a love feast, the old board of directors was re-elected, except that T. W. Finucane, of Rochester, replaced Frederick G. Corning, of New York. The "dissenters" were outnumbered about five to one. The directors took a good deal of the wind out of the sails of the opposition by holding a meeting before the annual meeting and doubling the dividend rate to $4 a year, payable at the rate of $1 a quarter. The president stated that on account of the vicissitudes of mining, this rate could not be guaranteed, but would be paid as long as profits warranted. With regard to the bylaw permitting the directors to split the stock into shares of no par value, the original intention was to issue four shares of no par value for each share of the present stock. It was pointed out that in the present form of $9 par value, the stock was not suited to the London market, while, on the other hand, New York would not accept stock under $10 as collateral. In view of this, the four for one split-up did not seem advisable at present. At a special general meeting of the company, held after the annual meeting, the directors were authorized to form a company, having shares of no par value, and were given authority to act as they considered best regarding what split-up should be made.

A. S. & R. Co. Resumes Dividends on Common; Rate $1.25 per Share

The directors of the American Smelting & Refining Co. have declared a quarterly dividend of $1.25 on the common stock and the regular quarterly dividend of $1.75 on the preferred. The common dividend is payable Aug. 1 to stock of record July 9 and preferred payable Sept. 1, to stock of record Aug. 10. The last previous dividend on the common stock was $1 a share paid March 15, 1921. Resumption at the $5 annual rate instead of at $4 shows that the directors of Smelting, who are in close touch with the mining industry throughout the country, have confidence that the mining industry has turned the corner definitely for the better. Business may slacken somewhat when the present large stocks of ore due to Pittman Act stimulation are settled.

Small Fire in Abandoned Shaft Gases Miners in Near-by Workings

Fire starting from an unknown cause and originating in the collar of No. 1 Tamarack Junior, an abandoned Calumet & Hecla shaft, recently burned down into the shaft timber 50 to 60 ft. before it was extinguished. The shaft is not connected with the active Calumet & Hecla workings under Tamarack Junior, but cracks and crevices enabled the gas, driven by a downward draft, to get through into the 57th level subshaft north of Calumet Nos. 5 and 6. Four miners were overcome by carbon monoxide but will recover. Nos. 5 and 6 were closed one day as a precautionary measure. The shafthouse at No. 1 Tamarack Junior was burned ten years ago and since then the shaft has been fenced. This event emphasizes the seriousness of any fire underground.

Schwab Interests Get Active Zinc Mines in Oklahoma

The Quapaw Mining Co., controlled by Charles M. Schwab, has acquired the property of the Tom L. Mining Co. and the Chubb Mining Co., owning mines and leases in the Oklahoma zinc-lead field. Both are active producers and have been appraised at $1,000 000.

Rumors of other important transactions are rife in the field as a result of the recent visit of Mr. Schwab himself. It is known that negotiations were on

between Mr. Schwab and the Oko Mining Co., represented in Oklahoma by T. F. Lennan. It was reported at one time that they were off, but just before Mr. Schwab left for the East they were resumed, and Mr. Lennan, on short notice, went East as a guest on the steel magnate's private car. It is expected that some sort of transaction will soon be announced. While in this field Mr. Schwab advised producers to get in closer co-operation.

Railroad Saves Alaskan Placer Miners Full Season

A convincing demonstration of the aid the Government Railway is giving, and will give, to mining in the interior of Alaska was afforded by the expedition with which a drag-line excavator plant for the Stewart, Denhart & Bradsetter enterprise was shipped from Seattle to its destination above Fairbanks. Ninety days after this outfit, which totaled 150 tons, left Seattle it was set up ready for operation on Caribou Creek, 60 miles from Fairbanks. The shipment went from Seattle to Seward by boat, where it was loaded onto flat cars and brought 468 miles to Fairbanks. Tractors were in readiness at Fairbanks, and the supplies were sledded the remaining 60 miles via the Richardson highway. When it became apparent that the snow would leave the highway before all the material reached its destination, the Road Commission loaned two of its tractors to expedite the hauling, with the result that this plant was landed and set up before the water began to run. In pre-railway days at least a full season would have been required to secure such results and thus a year would have been lost.

News from Washington

By PAUL WOOTON
Special Correspondent

Mineral-Filler Investigation Planned for New Brunswick Office

Oliver Bowles, Superintendent, Outlines Work of New Bureau of Mines Station—Field Work Necessary

The principal problems to be undertaken on the opening of the new nonmetals experiment station of the Bureau of Mines at New Brunswick, N. J., will be a continuance of the study of the difficulties met with in the quarrying and preparation of limestone and in lime manufacture, and a continuance of the work which has been in progress at the Tuscaloosa station on mineral fillers.

The work at the station necessarily will be limited, as the appropriation permits of the employment of three technical men only. As a considerable amount of work has been done on lime and mineral fillers, it is felt that the greatest good can be accomplished by carrying through the work already well in hand.

In lime the most important part of the work probably centers around efforts to utilize waste. There is reason to believe that improved methods of burning can be brought to the point where the smaller sizes can be burned.

It is possible that some work on slate will be taken up early in the life of the station. This is encouraged by the success which has attended large-scale pulverization of waste slate, and the increasing demand for this material as a filler in asphalt, roofing materials, paint, and rubber.

The problems of the non-metals are of such a character that field work is required in much larger proportion than laboratory work. The studies and the experiments must be carried on under operating conditions. For that reason, Oliver Bowles, who will be in charge of the new station, believes it is better to expend the appropriation in a way that will allow all necessary field work. Consequently he must limit the personnel of the station to a mineral technologist and a physical chemist. In case co-operative arrangements can be made with the industries concerned, it will be possible to expand the work beyond the program now being mapped out. The station will be opened July 1.

Four Win, Fourteen Lose Before War Minerals Relief Commission

The Secretary of the Interior has approved the following recommendations by John Briar, the War Minerals Relief Commissioner: Fowler Mining Co., tungsten, $1,362.82; McKinzie & Hollifield, tungsten, $983.97; F. L. Burnett, chrome, $209.80; Yates and Ulmer, tungsten, $657.31. The following claims have been disallowed: Arthur Harrington, chrome, stimulation not established; Unaka Minerals Co., manganese, no additional award allowed; Murphy & Thurman, manganese, not within the act; A. Grossman, manganese, commercial importance not established; Edna T. Mining Co., manganese, not within the act; Morris E. Johnson, manganese, not within the act; Layton & McCormick, manganese, no additional award allowed; John Varozza, chrome, net loss not established; Georgia Copper Co., pyrites, no government responsibility incurred; R. H. States, manganese, stimulation not established; National Pyrites & Copper Co., pyrites, no additional award allowed; East Tennessee Mining Co., manganese, no additional award allowed; C. J. Dold Mining Co., manganese, no additional award; Downtown Mines Co., manganese, net loss not established.

Director Declares Pittman Act Purchases Completed June 2

Has 3,000,000 oz. in Tenders on File—Thinks Adjustments Will Be Comparatively Small

The full text of the statement issued by the Director of the Mint on June 18 declaring completed the purchase of silver under the terms of the Pittman Act follows:

"In accordance with the public announcement made on May 29, 1923, the Director of the Mint stopped receiving tenders of silver under the act approved April 23, 1918, sometimes known as the Pittman Act, at the close of business Friday, June 15, 1923. Between May 29 and June 15 tenders of silver amounting to about 4,600,000 oz. were received, and of these tenders about 1,600,000 oz. have today been accepted in the order of their receipt. The tenders thus accepted include all those received in the office of the Director of the Mint to the close of business June 2, 1923.

"This makes the total amount of accepted tenders about 200,520,000 oz., which it is expected will satisfy the requirements of the act and provide for the recoinage of sufficient standard silver dollars to replace those used under the act. The remaining tenders received up to the close of business June 15, 1923, will be kept on file in the Bureau of the Mint in the order of their receipt and unless previously withdrawn will be accepted in that order, if, and to the extent that, further purchases may be proved to be necessary in order to adjust accounts or to correct excessive tenders. From the check which has been made of tenders received to date the indications are that these adjustments will be small.

"All tenders in excess of the total amount needed to fill the requirements of the act, namely 200,520,000 oz. or thereabouts, will be rejected."

Teaching Mexican Miners

Difficulty experienced in instructing Mexican miners, who form 75 per cent of the mine force in many Arizona mines, in safety work may be lessened by following these rules laid down by A. J. Martinson, of the U. S. Bureau of Mines:

1. Use bulletins in Mexican and encourage the shift bosses to bring the work and its importance to the attention of the men.

2. Separate the class into English and non-English speaking sections.

3. The interpreter must not speak the pure Spanish, but the Mexican the miners use. He should be well and favorably known among the men. If he is of Mexican origin, no doubt better results can be obtained.

4. The lectures must be cut to a minimum, as three or four sentences at a time is usually about the limit of the interpreter's memory.

5. It is helpful to show due appreciation for effort on the part of the men.

News by Mining Districts

By Special Correspondents in the Field

London Letter

Marriott Hopes to Revive Magadi Soda; Will Visit Australia—Sao Bento To Be Reopened

BY W. A. DOMAN

London, June 7—Hugh F. Marriott, formerly consulting engineer to the Central Mining & Investment Corporation, has by no means relaxed his activities. He is probably one of the busiest men in his profession. At the moment he is engaged in formulating a reconstruction scheme for the Magadi Soda Co. (East Africa). This company, which owns a vast deposit in Lake Magadi, has always been "up against" established interests, and owing also to difficulties during the war, has come to grief. That it can be made commercially successful no one doubts, and the task of pulling it through is entrusted to Mr. Marriott. He is soon proceeding to Australia. For one thing he will represent the Home Government in Mining Science at the forthcoming Congress at Melbourne. His prime reason for undertaking the trip is that he has been nominated as delegate to the congress by the Institutions of Mining and Metallurgy and Mining Engineers. Further, he has been asked by the Imperial Mineral Resources Bureau to discuss with the Australian authorities the work on hand toward centralizing information on the mineral resources of the British Empire. Another item of his mission is to discuss with the Australian Institute the formation of an Empire Council comprised of representatives from all the leading British technical associations of the profession. If time permits, Mr. Marriott hopes to pay a flying visit to Broken Hill, and to call at Magadi on the return journey.

J. F. Teale, principal partner in the firm of Bainbridge, Seymour & Co., London, has left on a trip to Brazil in connection with the reopening of the Sao Bento Gold Mines. Many years ago these mines were operated under the management of John Taylor & Sons, but various difficulties prevented them from being turned to profitable account. A re-examination has taken place, and owing to the advance in metallurgical science it is confidently believed that capital can be made remunerative. There is a certain amount of machinery on the property, and a fair tonnage of ore is developed. It is hoped to acquire the extension of the lodes, which in places have given good indications. The Sao Bento is now known as the South American Gold Areas, Ltd. It has a capital of £200 000 in £1 shares.

The Sixth International Mining Exhibition was opened at the Royal Agricultural Hall, London, N., on June 1, by Sir John Cadman, president of the Institution of Mining Engineers, in the unavoidable absence of Sir Philip Lloyd-Greame, M.P., president of the Board of Trade. It will remain open until this day week. The exhibition is of a more international character than in any former year, as the governments of France, Belgium, Mexico, and Colombia are represented, and there are also exhibits from the United States, the Belgian Congo, Malaya, and Nigeria. For the first time oil and china clay are included among the exhibits. The Imperial Institute, the Imperial College of Science and Technology, the Imperial Mineral Resources Bureau, and the Gold Coast Geological Survey are exhibitors. The present exhibition is, in fact, the most comprehensive and important of the series begun twenty years ago. There are no regular dates for the exhibitions; they are determined by the mands of the mining industry.

San Francisco Letter

Mining Congress Meets — Wages Increased 50c. in Grass Valley—Special Dividend for California Rand

By Our Special Correspondent.

San Francisco, June 18—During the week ending June 16, the western division of the American Mining Congress held sessions in San Francisco and Sacramento. The meeting in San Francisco was for the purpose of formulating resolutions to be submitted to the parent organization; the meeting at Sacramento was a general meeting at which were discussed western problems, the most important being the silver question.

The Mountain Copper Co. has put a small crew of men on the Iron Mountain mine preliminary to resuming mining work. The Mammoth Copper Co. has let a contract for the repair of the road between Kennett and the Balaklala mine. The American mine, owned by the Concordia Mining Co., and near French Gulch, has started operations, with fifteen men on its payroll. The Shasta Iron Co. is shipping several cars of iron ore each week from its mine near Heroult. The ore is being used by the open-hearth plants at Pittsburg and South San Francisco.

A new wage scale applying generally to the Grass Valley district will be in force on July 1, 1923. The advance approximates 50c., making the wage for miners $5.25 per day. More or less shortage of skilled labor is reported. The North Star has curtailed milling operations, the Idaho-Maryland is operating 20 stamps and is completing the extension to its present shaft, and the Empire is operating 80 stamps. The shaft at the Alta Hill is down 125 ft. and bedrock is expected at 200 ft. The Brunswick is planning on sinking its main shaft deeper. Small operations in the vicinity of Nevada City are increasing, and drift mining is attracting more than the usual attention.

The winze at the Plymouth Consolidated has reached a depth of 3,992 ft.; the north and south drives on the 3,925 level have been extended to 447 and 275 ft. respectively. Ore of good grade and width appears in the winze and drift ends. The Kennedy mine has finished the repairs to its hoist, and started unwatering on June 11. Milling operations will be resumed soon.

The California Rand Silver, Inc., in addition to its usual monthly dividend, has declared an extra dividend of 10c. per share. Production in May was 7,809 tons of milling ore and 1,034 tons of shipping ore.

BRITISH COLUMBIA

Florence Will Increase Output

Production of shipping ore and concentrate at the Florence mine, near Ainsworth, will be raised from 175 tons to 300 tons daily in a short time. Contracts have been made with the city of Nelson to build a 13-mile transmission line and supply 1,000 hp., which have been confirmed by a rate-payers' election held in Nelson recently. A new electric locomotive for mine transportation has been purchased to replace the steam locomotive used in hauling from the mine to mill.

Increase in the capacity of the mill from 300 to 500 tons daily is assured, and work will begin soon. Five to six months will be necessary to complete the work, and milling operations will be carried on at the same time. Underground development will be carried on by extending the No. 2 and 5 tunnels to other known ore deposits, and a long lower tunnel will be started from the lake shore.

O.K. Mine Again Unwatered

Work of unwatering the O.K. mine, near Ashcroft, has been started. The mine is being pumped out preliminary to inspection by Duluth people who are planning to take it over. This is the second time the mine has been unwatered in the last few years.

Tidewater Mines 200 Tons Daily

The Tidewater Copper Co., at Sidney Inlet, Vancouver Island, has overcome power difficulties, through intermittent water shortage, by the installation of a 300 hp. Deisel engine. Two hundred tons of ore is being mined per day, from which there is a recovery of about 12,000 lb. of copper, together with some gold and silver. At twenty-day intervals the company ships 4,000 tons of concentrates to the Tacoma smelter.

Low-Grade Gold Ore Opened

The Peace River Mining & Milling Co. has under development a large group of free-milling low-grade gold properties situated on Mount Selwyn, about three miles below the junction of the Parsnip and Findlay rivers. Systematic sampling of the exposures was done last season, and this year machinery and supplies are to be taken in to permit the carrying on of development. It is understood that the company proposes to test 200 tons of the ore, and, if this is satisfactory, preparations will be made for large-scale operations.

ONTARIO

Gold and Silver Output Less in First Quarter

The silver output of Ontario was valued at $1,792,876 for the three months ended March 31, 1923, a decrease of approximately $200,000, as compared with the corresponding quarter of 1922. The chief producers were: Nipissing, 911,000 oz.; Keeley, 530,000 oz., Mining Corporation, 311,000 oz.; Frontier (which is owned by the Mining Corporation), 297,000 oz., and Coniagas, 268,000 oz. Due to the hydro-electric power shortage the output of gold showed a decrease, the value being $4,373,513, compared with $4,675,475. Considering the seriousness of the power shortage, however, this reduction is small. In the Porcupine district the Dome produced the highest-grade ore, the average heads being $12.81; the McIntyre was $11.12 and the Hollinger $7.61. In addition to the falling off in production, amounting to about 30 per cent, the Hollinger heads were lower than during the 1922 quarter; although the Dome was forced to curtail the tonnage, the high-grade heads resulted in the output equaling that of last year. In Kirkland Lake the Teck Hughes, with an average grade of $29.42, was easily the highest grade producer in Ontario, and probably in Canada. The average grade of the Lake Shore was $22.74; the Wright-Hargreaves, $9.04; Kirkland Lake Proprietary, which treated only a small tonnage, averaged $6.64, and the Kirkland Lake was only $4.80. At the present time Northern Ontario gold properties are producing at the rate of approximately $2,000,000 a month.

MEXICO

New Equipment for Jimulco

T. S. James, manager of the Jimulco Mining Co., returned recently from El Paso, where he purchased new machinery for the mines, which are near Otto station a short distance south of Torreon. He will install a Fairbanks-Morse crude-oil engine, and an Ingersoll-Rand air compressor, for power drilling. The mines operated continuously during the revolution and large dividends have been paid yearly since the company was organized in 1901 in San Antonio, Tex.

The principal properties are the Defensa, Reforma, Esperanza and San Juan. There are a number of operating shafts, with main and prospecting tunnels. The ores carry from 6 to 7 per cent copper, with about 6 oz. silver per ton. The company owns its private narrow-gage railroad, which is about five miles long and connects with the main lines of the National Railways of Mexico at Otto.

Old Mine Being Examined

An examination of the famous Promontorio mines is being made by engineers. Over one thousand samples have so far been taken for assaying. These properties belong to the Maximiliano Damm estate. They are about 80 miles from the Chinacates station, in the State of Durango.

The ore occurs in a fissure vein, dipping vertically from the surface with southwesterly dip at depth, carrying silver, with some gold and copper. The main shaft is down about 700 ft., with a number of levels which have been worked for a distance of about 1,000 ft.

Prior to the revolution the ores were conveyed by train to the 50-ton concentrator, having a cyanide plant and 60-ton smelter with a matting furnace. During that period about 100 men were employed.

CALIFORNIA

Moore Mill Down—Shaft Deepened —Ore on 640 Level

The Moore Mining Co. shut down its mill temporarily on April 3, and attention has since that date been given entirely to sinking. As a result a new level has now been opened 100 ft. below the former lowest level (the 540). The vein on the new level has been opened for a distance of about 35 ft. and appears as a good body of quartz about 7 ft. in width, getting appreciably wider toward the north. Thorough sampling shows it to have an average assay value of about $15 in gold per ton, the last sample across the north face assaying $15.71, and the last sample across the south face assaying $18.60.

Under the former operations, there was difficulty in maintaining average mill heads and the loss in tailing was excessive. Both of these unfavorable conditions will be reduced to a minimum from now on. It is expected that profitable operation will be possible.

Moore mill, at Jackson, Calif.

ALASKA

Placer Operators Busy—Two Dredges at Work

By our Special Correspondent

The ice is out of all the rivers in interior Alaska and the placer miners are "making hay" while the water runs. There were no large outfits getting out dumps last winter, but most of the prominent creeks were worked at various points by small crews and their cumulative production will outrank that of the preceding winter. The winter dumps are now being sluiced, and some fairly good clean-ups are being made. Some report a nice profit; many simply made wages; and a few did not do even that. The summer placers employing hydraulic equipment, scrapers, or dragline excavators have been under way since June first.

The Fairbanks Dredging Co. will operate two boats this summer on Fairbanks Creek. Its new dredge is tuned up and will be digging as soon as the first block of ground is thawed. In its smaller dredge, the wood-burning engines are being replaced by a Diesel plant. These are the only dredges operating this season in the Fairbanks district.

New Dredge for Kuskokwim

G. W. C. Glass and associates are shipping in a new dredge which will be placed on Gaines Creek, in the Kuskokwim district. This dredge, which is of the flume type and equipped with 2½-ft. buckets, should arrive on the first river boat.

WASHINGTON

Need Cars at Republic

Car shortage in the Republic district is interfering with the production in that camp. The May output from the three mines shipping was 2,200 tons, which went to the Trail smelter.

Chloride Queen Taps Vein at 900 Ft.

The Chloride Queen mine, near Colville, reports striking on the 900 level a 60 ft. vein which appears on the surface. Assays return 20 oz. silver and $3 in gold. The vein has been penetrated 6 ft., and crosscutting will continue to the hanging wall, according to D. E. Zent, manager.

Cobalt Ore Reported

In the same vicinity a rich strike has been reported on the Silver Crest mine, near Aladdin. It is reported by William Riddick, manager, that assays show the presence of cobalt, lead, and silver. New machinery is being installed at the mine and active development of the new shoot will be pushed.

UTAH

Utah Apex Develops 2,000 Level

The main shaft of the Utah Apex Mining Co. at Bingham is now down to 2,250 ft. and exploration is advancing rapidly at the 2,000 level for development of probable extensions of the orebodies now being exploited in the upper levels. The company has recently acquired, by purchase, a number of mining properties contiguous to the Utah-Apex ground.

Production during the first eight months of the present fiscal year is as follows:

Gold, oz., 1,718; silver, oz., 276,670; lead, lb., 14,730,695; copper, lb., 925,-440; zinc, lb., 5,494,282.

After paying current dividends, all litigation expenses, mill improvements, and the purchase of mining properties, there is a balance of $1,073,834 in cash and negotiable securities in the treasury, exclusive of ore in transit.

MONTANA

Tuolumne Will Deepen Main Range Shaft

The management of the Tuolumne Copper Co. denies the rumor that operation at the Main Range mine will be stopped. All development work on the different levels of the Main Range mine has been stopped, and preparations for sinking will be made immediately. Actual sinking will not be started for about a month. It is the intention to sink about 400 ft. This will make the shaft 2,800 ft. deep.

The Tuolumne company has shipped little ore in the last few years, but has done a great deal of development work on the lower levels of the Main Range. The Spread Delight vein was opened up on the 2,000 and 2,200 levels and several places were found where low-grade ore could be procured.

Jardine Mining Co. to Double Production

Plans are well under way at the Jardine Mining Co.'s property, at Jardine, to increase the gold and arsenic output by 100 per cent. The present output is said to be more than 100 tons of arsenic per month.

Davis-Daly Experts Mobilize

During the last week the geological experts for the Davis-Daly Copper Co. have been busily engaged on exploration work pertaining to the impending litigation with the Anaconda Copper Mining Co., which is now on the federal court future calendar. Those who arrived during the week were Dr. Walter Harvey Weed, Albert Burch, Oscar Hershey and E. Chase. Waldemar Lindgren is expected to arrive at an early date.

Butte-Los Angeles Begins Operations

Work was started June 4 by the Butte-Los Angeles Mining Co. on a tunnel to develop a group of five claims situated about twelve miles west of the Butte district proper. The ground is owned by the Northern Pacific Railway Co. and was recently taken over by Maurice Esenberg, of New York, on a long-term lease. He is a former Butte man and founder of the British-Butte company, which operated about four miles west of Butte a few years ago. The tunnel project as planned calls for 700 ft. of work. Other development work will be undertaken as soon as tunnel is completed.

NEVADA

Operations at Tonopah Taper Slightly

Production by the Tonopah mines during the last fifteen days of May was above normal, due to efforts to take advantage of dollar silver while it lasted. The Tonopah Belmont shipped bullion valued at $174,000, West End $83,000, Tonopah Mining $80,000, and Tonopah Extension $75,000. Since June 1 some of the mines have reduced tonnage, it being necessary to sort the ore more closely to make a profitable grade, and probably 100 men have been laid off at the Tonopah Mining and Belmont properties. The West End, Tonopah Extension, Halifax and smaller properties are operating as usual. It is likely that the quantity of bullion made will hold fairly steady at, or slightly below, normal for some time to come.

Rochester Expects to Shut Down

The Rochester Silver Corporation recently shipped 29,968 oz. of bullion, representing the clean-up for the last half of May, making a total production of 56,267 oz. for the month. Company officials had expected to be forced to close down as soon as silver purchases under the Pittman Act were completed, but there is so much uncertainty at present regarding its completion that it was deemed proper to continue operations for the present. The Rochester ore is average low grade and at dollar silver yielded a profit of about $2 per ton. Practically all values are in silver, so that grade would have to be raised to operate at a profit with present market quotations for silver.

Outlook Bad for Candelaria

The Candelaria Mines Co. milled 12,-225 tons of ore in May. Neither per-ton values or bullion returns have been published, but it is generally believed that without the development of new and better-grade orebodies the Candelaria mines will be unable to operate at a profit with silver around 65c. per ounce.

Tolicha Ore Not High Grade

The first carload of ore shipped from Tolicha district, near Goldfield, ran $32 per ton, which is just about what the shippers claimed for it. Another car has been shipped, this ore said to be of better grade, estimated to run over $150 per ton. This ore was mined from the group of claims held under option by Knox and associates.

There is considerable activity in the district, with many transfers of ground, but little actual development work is being performed.

ARIZONA

Prospect for Meteor Near Winslow

Once more efforts are to be made to prospect for a large meteor that is believed to lie below the surface of a large depression occurring on Meteor Mountain, about twenty miles west of Winslow. The "cavity" is 4,400 ft. in diameter and 500 ft. deep; and small pieces of meteorite containing iron, nickel, and other metals, in proportions that make prospecting for a large deposit attractive, have been found on the mountain. Many attempts have been made to locate the meteor, mainly by drilling in the crater-like depression. A recent drill hole was lost at a depth of 1,200 ft. when the drill became stuck. Plans are now being made to sink a shaft to search for the treasure.

MICHIGAN

Labor Situation Bad in Copper Mines

Although some men are being imported into the Michigan copper district, the labor situation generally is more serious than three months ago. One mine shows a net loss of 200 men since that time. Production is falling off somewhat on this account, but not to the extent it would were a normal program followed. Much less "dead work" is being done than formerly and principal emphasis is being placed on output.

Would Welcome Ford in Copper Country

There is still a feeling in the copper mining circles that Henry Ford will acquire a copper property eventually. Though no negotiations have ever been entered into, it is understood the Detroit manufacturer would have no difficulty in purchasing a mine if he set out to do so, regardless of share ownership in every Michigan copper corporation. The advent of Ford really would be welcomed, as it is felt he would attract labor and all mines would benefit thereby. Ford is a large user of raw materials and he now owns sources of supply of every essential except copper. Although he has an extensive acreage of mineral land in the upper peninsula of Michigan, none of it carries copper in commercial quantity. Some of it includes what is known as the secondary group of ranges, but copper in these formations is sparsely disseminated.

New Shaft for Castile Mine

The Castile Mining Co., operating the Eureka, Asteroid, and Castile mines, near Ironwood, is to start work on a new shaft, to be sunk between the present Eureka and Asteroid shafts. It is to be equipped for a depth of over 4,000 ft., will start in the iron-bearing formation, and will later penetrate the footwall. At this point, which is a little west and north of the open-pit mines, the formation is broken up by some large faults, making it almost a necessity to locate the collar of the shaft in the iron-bearing formation instead of in the footwall, as is now the general practice on this range.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
14	14.875	40.875	41.375	7.25	6.90	6.05@6.10
15	14.875	40.50	41.00	7.25	6.90	6.00
16	14.875	40.50	41.00	7.25	6.90	5.95@6.00
18	14.80@14.875	40.00	40.50	7.25	6.90	5.95
19	14.75@14.875	39.75	40.25	7.25	6.90	5.925@5.95
20	14.75@14.875	40.25	40.75	7.25	6.90	5.90
Av.	14.848	40.313	40.813	7.25	6.90	5.973

*These prices correspond to the following quotations for copper delivered: June 14th, 15th and 16th, 15.125c.; 18th, 15.05@15.125c.; 19th and 20th, 15.00@15.125c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. The quotations are for prompt deliveries. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
14	68¼	68⅝	74½	194⅛	194½	25¾	25⅛	29½	29⅞
15	68	68⅜	74½	192¼	193	25¾	25⅛	29½	29⅞
18	67¼	67⅝	74	190	190⅞	25½	24⅞	29½	29⅞
19	66⅝	67	73½	187¾	188⅜	25⅛	24⅝	29¼	29½
20	66⅜	66¾	73	190½	191	25⅛	24⅝	29	29⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

June	Sterling Exchange "Checks"	Silver		Gold	June	Sterling Exchange "Checks"	Silver		Gold
		New York	London	London			New York	London	London
14	4.61	65⅛	31¾	89s. 5d.	18	4.61¾	65⅞	32 1/16	89s. 3d.
15	4.61⅛	65½	31 15/16	89s. 4d.	19	4.62	65¾	32	89s. 2d.
16	4.60¾	65¾	32 1/16	....	20	4.61⅞	65¼	31¾	89s. 3d.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, June 20, 1923

The metal markets have been inactive without exception all week. Consumers all report that their plants are as busy as the supply of labor will permit, but there continues to be less business booked ahead, and with the general tendency to a decline in the commodity price level, they are not buying metal so far forward as normally. The European situation seems no better, and the failures of two big financial houses here in New York—Knauth, Nachod & Kuhne and that of Zimmermann & Forshay, announced at noon today—have had an unfavorable sentimental effect.

Copper

The spurt in business which was reported last week continued pretty well up to Saturday, but in the last three days orders have been few and far between again. Some copper was sold as high as 15.25c., delivered, on last Wednesday and Thursday, but the volume of business at this level was small, and most producers reverted to the 15⅛c. level on Thursday or Friday, a price which is still generally quoted. In an effort to sell, however, two or three interests have shaded this price; nominally they are asking 15⅛c., but actually they are willing to accept as low as 15c. on attractive business. There is little pressure to sell except at full prices, however. Most of the orders continue to be for August or September, though there is a demand occasionally for nearer deliveries.

The export market has tapered off somewhat, but the volume is still fairly good, at prices netting producers about one-quarter cent above domestic business.

The campaign to increase the use of copper and brass has been successful and continues unabated. Several new members have joined the Copper and Brass Research Association as follows: Engels Copper Mining Co., Granby Consolidated Mining, Smelting & Power Co., Dallas Brass & Copper Co., Merchant & Evans Co., T. E. Conklin Brass & Copper Co., J. M. & L. A. Osborn Co., and Richards & Co., Ltd. A similar organization, known as the Copper and Brass Extended Uses Council, has just been organized in England.

Lead

The official price of the American Smelting & Refining Co. continues at 7.25c., New York.

Sales have been slightly better than last week, but the volume of business outside of regular contract orders continues below the recent normal. Consumption is active, however; stocks are practically non-existent, and producers are showing no tendency to press lead on the market, at least in the East. In the vicinity of St. Louis, the offerings of one interest, as mentioned last week, continue to exert a depressing influence on the market, and the full freight differential now exists between New York and St. Louis prices. As a result, Middle Western producers are now competing on even terms throughout the eastern territory for the first time in many months. It is rumored that lead was obtainable from one source as low as 6⅞c., St. Louis, yesterday and today, but we have been unable to confirm this quotation. However, this price is possible, for lead has been freely offered all week in lots from a car to several hundred tons, at 6.90c. In Chicago, the market seems to be more variable, various prices from 6.925 to 7c. being heard.

Most consuming lines seem as busy as ever. Cable manufacturers report that their plants have orders ahead for practically all of the remainder of the year, and the mixed-metal business seems to continue unusually active.

Zinc

Zinc seems to be the weakest of the non-ferrous metals. At 6c., there was a slight hesitation in the downward

trend, but sellers were soon found at under this figure, and there was no difficulty in finding sellers for June shipment today at 6.90c. though nominally quotations were 6.95c. There is a free supply of spot metal of Prime Western grade, and a slight premium, say of 2½ points, is generally asked for July and August, over the June price. The consumption by galvanizers has been unsatisfactory for some time, and there is yet no evidence that it will soon improve. The brass manufacturers have been much better consumers, though they require more of the higher grades of zinc. For this reason, high-grade zinc has not declined like Prime Western, and continues to sell at from 8.50@9c. delivered in the East, and at 8@8.50c. delivered in the Middle West. Business in this grade has not been particularly active during the last week, but producers are well sold up.

So far, there seems to be no indication of a drop in zinc production, though it is evident that domestic consumption cannot absorb all that is now coming from the reduction plants. Many smelters are making no money, on account of the high prices that are being paid for ore, and if conditions do not improve soon, it is likely that some furnaces wil be shut down.

Tin

Prices have declined quite regularly this week, without any apparent reason other than a pessimistic feeling in London. Most of the local business has been between dealers, though the local prices that were reached yesterday, when July Straits broke under the 40c. level, stimulated some orders from consumers. Prices for three months' forward delivery here have been about one-quarter cent below those asked for spot throughout the week.

Arrivals of tin, in long tons: June 13, Australia, 5; 14th, Australia, 25; 18th, Java, 50; total so far in June, 1,710.

Foreign Exchange

Continental exchanges have shown a tendency to taper off somewhat compared with last week's levels, the market for French francs being rather bearish, and German marks having declined to something like 130,000 to the dollar. Cable quotations on Tuesday, June 19, for francs were, 6.22c.; lire, 4.5425c.; marks, 0.0009c.; and Canadian dollars, 2 3/32 per cent discount.

Silver

During the last week the market advanced on the strength of India bazaar buying, but has sagged off again at the close due to China sales in London, and small demand for San Francisco delivery. The market closes quiet with tendency uncertain.

Mexican Dollars—June 14th, 49⅝; 15th, 50; 16th, 50¼; 18th, 50¼; 19th, 50¼; 20th, 49¾.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—General market for 99 per cent grade, 27½c. per lb.; 98 per cent, 26c. London £115.

Antimony — Chinese and Japanese brands, 6.75c. per lb. W.C.C., 7.50c. Cookson's "C" grade, spot, 10@10½c. Less disposition to cut present prices.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—$1 per lb. London, 5s.

Iridium—$275@$300 per oz.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £130@£135 per long ton.

Palladium—$80@$81 per oz.

Platinum — $116 per oz. London, sponge, £22½; manufactured, £24½.

Quicksilver — $67.50@$68 per 75-lb. flask. San Francisco wires $67.15. London, £10 10s.

The prices of **Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium** and **Tungsten** are unchanged from prices given June 9.

Metallic Ores

Chrome Ore — Indian chrome ore, $20.50 per ton, c.i.f. Atlantic ports. Rhodesian $22 and New Caledonian, $24@$25, nominal.

Tungsten Ore—Wolframite, $8.75@$9; scheelite, $8.50@$9 per unit of WO_3.

Iron Ore, Magnesite, Manganese, Molybdenum, Tantalum, Titanium, Uranium, Vanadium, and **Zircon Ore** are unchanged from the quotations published June 9.

Zinc and Lead Ore Markets

Joplin, Mo., June 16—Zinc blende, per ton, high, $39.90; basis 60 per cent zinc, premium, $36.50; Prime Western, $36@$35; fines and slimes, $35@$32; average settling price, all zinc ores, $36.54.

Lead, high, $104.05; basis 80 per cent lead, $90@$91; average settling price, all lead ores, $97.34 per ton.

Shipments for the week: Blende, 10,298; lead, 1,951 tons. Value, all ores the week, $566,230.

Though there are holders of zinc blende who decline to accept current prices, buyers have little difficulty in filling limited orders, even though prices continue to decline. Sheet zinc manufacturers continue the heaviest buyers, in proportion to their average purchases, and are shipping a tonnage double their first-quarter average.

Platteville, Wis., June 16.—Blende, basis 60 per cent zinc, $40 per ton. Lead, basis 80 per cent lead, $92 per ton. Shipments for the week: Blende, 498 tons; lead, none. Shipments for the year: Blende, 16,434; lead, 340 tons. Shipments for the week to separating plants, 924 tons blende.

Non-Metallic Minerals

Fluorspar—Imported spar, fluxing grade, 85 per cent CaF_2, $8.50@$13 per net ton, c.i.f. New York, in bond; enamel grade, 95 per cent plus, $18@$19, do.; acid grade, 97½ per cent plus, $22@$23, do. Duty, $5.60 per gross ton. Market active but resistant to higher prices. Other prices unchanged from those reported June 9.

Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, Talc, and **Tripoli** are unchanged from the June 9 prices.

Mineral Products

Arsenious Oxide (white arsenic)—13½c. per lb. for prompt. July, 12c. Second half 1923, 11c.

Copper Sulphate — Large crystals, 5.75c.; small, 5.65c. for domestic. Imported bluestone as low as 5c.

Sodium Nitrate — $2.45@$2.52½ per 100 lb.

Potassium Sulphate and **Sodium Sulphate** are unchanged from quotations of June 9.

Ferro-Alloys

Ferromanganese — Domestic 78@82 per cent, $125 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $45@$47.50, f.o.b. furnace; 16@19 per cent, $43@$46.50.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium, and **Ferrovanadium** are unchanged from the prices published June 9.

Metal Products

Rolled Copper—Sheets, 24.25c., base; wire, 18c.

Lead Sheets, Nickel Silver, Yellow Metal, and **Zinc Sheets** are unchanged from the prices given in the June 9 issue.

Refractories

Bauxite Brick, Chrome Brick, Chrom-Cement, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the June 9 prices.

The Iron Trade

Pittsburgh, June 19, 1923

Production of steel is tapering off slightly, on account of weather conditions. Consumption continues heavy and is probably higher than the average of the past six months. Even the automobile industry has thus far had scarcely any seasonal slowing down.

Finished-steel prices are firm. There are the usual rumors of shading in some lines, but the large sales show that the market is firm, and the sales are large even though they are considerably less than shipments.

Semi-finished steel is easier and there are occasional offerings at slightly less than the regular price, which is $45.

Pig Iron—Foundry iron, on sales of small tonnages, above carloads, is down $1, at $28 to $29, Valley. Bessemer is easy at $29, Valley. Last reported sales of basic were at $27.50, Valley, but it is commonly believed a lower price can now be done.

Connellsville Coke—The common asking price on third-quarter furnace coke contracts is $5.50, but this can be shaded. Uncovered furnaces are disposed to hold off, and may buy only from month to month, or for shorter periods. Spot coke is easy at $5 for furnace and $5.75@$6.25 for foundry.

The Lead Industry and Market in France

SPECIAL FOREIGN CORRESPONDENCE

FRANCE, excepting her colonies, now produces hardly any lead ores. The Pontgibaud mine, situated in the département du Puy-de-Dôme (center of France) has been idle since 1897, as it was no longer profitable. Other lead-ore concessions are of small importance, and their production may be considered almost negligible: about 1,500 metric tons per month of lead ores of various grades.

PRODUCTION OF FRENCH NORTHERN AFRICA

But if France proper is poor in payable lead deposits, her dependencies of northern Africa, Tunis and Algeria, contain rather important deposits of galena and of carbonate of lead, grading on the whole about 60 per cent. Before the war, Tunis produced annually about 60,000 metric tons of lead ore, from which 36,000 metric tons of metal was obtained. Owing to the restriction of sales, to the high working costs, and, also, to the lack of labor, Tunisian production has now dwindled to approximately 40,000 metric tons of ores, and, consequently, about 24,000 metric tons of lead metal per annum. On the other hand, Algeria produced before 1914 about 15,000 to 20,000 metric tons of lead ore, and its present production is showing proportionately the same decrease as the production of the neighboring Tunis Regency.

Most of the Tunisian lead ores are smelted at the Mégrine plant, near the city of Tunis, which, before the war, was controlled by the Metallgesellschaft of Frankfort, and which since then has been taken over by the Société de Peñarroya.

The price charged for galena is reckoned as follows: 95 per cent of the lead contents of the ore paid at the average London price; plus the full value of the silver paid at the London price, less 150 fr. for smelting expenses.

Lead ores from Tunis exported as such are subject to a Tunisian export duty of 2 per cent ad valorem.

French Imports and Exports of Lead in 1922 and During the First Quarter of 1923 (According to French Customs' Returns)

I—IMPORTS

		In 1922, Metric Tons	During the First Quarter of 1923, Metric Tons
Raw lead	argentiferous	1,527	3,724
	non-argentiferous	70,357	16,061
Antimonial lead		1,503	302
Rolled lead		136	34
Scrap		385	166
Pipes and other finished product		243	34
Lead ores		21,179	2,225

Non-argentiferous raw lead was received from the following countries:

	In 1922, Metric Tons	During the First Quarter of 1923, Metric Tons
Great Britain	6,023	175
Spain	7,422	3,724
Mexico	16,970	4,987
Tunis	13,677	1,631
Belgium and Luxemburg	12,656	1,385
United States of America	9,814	3,734
Other countries	3,795	425
	70,357	16,061

II—EXPORTS

		In 1922, Metric Tons	During the First Quarter of 1923, Metric Tons
Raw lead	argentiferous	40	5
	non-argentiferous	4,818	115
Antimonial lead		28	25
Rolled lead		209	64
Scrap		1,134	239
Pipes and other finished products		1,674	311
Lead ores		6,128	2,492

FRENCH CONSUMPTION OF LEAD

Before the war, France consumed about 100,000 metric tons of lead per annum. Her present consumption—which can be deduced from the above figures of imports and exports—is somewhat less—about 80,000 to 90,000 metric tons. Practically no stock is being carried. The principal cause of the decrease of French lead consumption since the war is the comparative inactivity of the building trades, except in the devastated areas. There was indeed a semblance of revival last year, but, of course, the present political situation is having a restrictive influence. On the other hand, the fact that the problem of reparations is still in abeyance, with the French budget showing a heavy uncovered balance, will probably necessitate this year the slowing down of reconstruction work in war-stricken districts.

We may also report a decrease, due also to the slackness of the building trades, in the consumption of red lead and white lead, as well as a decrease in the consumption of lead and lead products by the china and glass trades.

DETAILS ON LEAD IMPORTS FROM VARIOUS COUNTRIES

From Spain, besides lead from the Peñarroya mines, France imports a small tonnage from La Cruz. Last year a rather important tonnage of Mexican lead was imported, but the lack of sales has caused the Mexican metal to drift on to London. At the London cash price it is selling at, the Perth Amboy lead which France imports from the United States is certainly rather cheap. However, this brand is not liked so well as Spanish lead, especially because it contains a rather high percentage of bismuth. Formally, some Enthoven (British lead) was imported, but the present premium on this brand is too high to allow of its competing against Spanish and Mexican brands. Belgian lead from the Société de la Vieille-Montagne is exported to France at the rate of a few thousand tons per annum. Burma and Australian leads cannot now be imported in France, owing to prohibitive customs duties applying specifically to them: 14 fr. per 100 kgs. × 2.2 (coefficient of increment) = 30 fr., 80. Tadanac brand of electrolytic lead is casually sold in France at good prices, but for small tonnages.

FRENCH CUSTOMS DUTIES ON LEAD

The rate which applies to imports of lead from Burma and Australia was mentioned above. It is the maximum rate of the tariff, the same, for instance, which applies also to imports from Germany. Belgian, Mexican, and British leads are paying 3 fr., 50 × 2.2 = 7 fr., 70; Spanish lead 1 fr. more—viz. 8 fr., 70—and lead from the United States 4 fr. × 2.2 = 8 fr., 80 (all per 100 kg.).

CONDITIONS GOVERNING PRICES

Spanish and Mexican leads are selling in France at about 15s. per ton above the average London price; lead from the United States (as noted above) at the cash London price.

The official prices of raw metals quoted every Saturday at the Paris Bourse du Commerce give but a vague idea of the prices really paid by French consumers.

List of the Principal French Lead Smelters and Transformers

Société des Mines et Fonderies de Pontgibaud (at its Couéron works, near Nantes): Smelts lead ores it purchases from Tunis, Algeria, Sardinia and Greece (Laurium mines); desilverizes lead metal; makes sheets, pipes, and gun shot.

Société "Affinerie Française" (at its works of Lescure-lés-Rouen): Produces soft pig-lead, antimonial lead of all grades, metal for printing types, and all other lead alloys.

Serres establishments in Paris: Supply nearly all the Paris newspapers with lead for linotypes and block-making.

Messrs. Marcel Bassot & Cie., 14, rue de Turenne, Paris (at their works in Harfleur and Rouelles [Seine Inférieure]): Are rolling and drawing lead into pipes and wire and are making their "Rex" metal used for canalization of drinking water under pressure.

Société des Fonderies, Laminoirs et Ateliers de Biache Saint-Vaast (Pas-de-Calais): Is now reconstructing its works destroyed during the war, whereat it formerly treated lead and other non-ferrous metals.

Messrs. Bidault & Cie., Paris: Are making lead pipes both at their Paris (Grenelle) plant and in their works situated at Halluin (Nord).

The Compagnie Francaise des Métaux: Is treating lead both at its Saint-Denis (near Paris) and Lille works.

The Société de Peñarroya: Is treating lead ore and metal at Mégrine (near Tunis), at Marseilles, and at Noyelles-

Godault (Nord). This latter plant was formerly owned by the Société des Mines de Malfidano.

Substitution of Iron for Lead Pipes Does Not Prove Popular

The endeavors made for substituting iron pipes for the customary lead pipes are not so far very promising of success. In Alsace-Lorraine, where, before 1918, it was forbidden to use lead pipes in house building, iron pipes are now being replaced, whenever occasion arises, by lead pipes. Iron rusts and grows valueless, whereas lead scrap can always be resold at a loss which rarely exceeds 10 per cent of its cost.

Gold and Silver Movements

The total United States merchandise exports for the five months beginning Jan. 1, 1923, according to the U. S. Department of Commerce, were $1,628,175,477, the imports were $1,765,757,586, showing a balance against the United States of $137,582,109. The total net imports of gold and silver since Jan. 1, 1923, were $91,241,635. The total merchandise and gold and silver balances against the United States were therefore $228,823,744, for this period. The net movement of invisible exchange for the same period, of course, cannot be estimated, but it will probably show further net balances against the country. In this connection one item of increased volume during the last four months has been the withdrawals of American currency for export to Europe.

The exhaustive investigation now being carried on by the department, in co-operation with the banks and other institutions, into the volume of invisible items in 1922 is expected to be ready about July 1.

Gold and Silver Imports and Exports

In Dollars

	May		Eleven Months Ended May		Increase (+)
Gold	1923	1922	1923	1922	Decrease (—)
Imports	45,356,331	8,993,957	263,856,147	455,341,637	—191,485,490
Exports	824,444	3,406,658	48,473,491	25,744,528	+ 22,728,963
Excess of imports	44,531,887	5,587,299	215,382,656	429,597,109	
Silver					
Imports	4,459,837	5,511,553	58,879,769	64,338,554	—5,458,785
Exports	3,499,358	5,676,755	52,325,875	56,690,256	—4,364,381
Excess of imports	960,479	.....	6,553,894	7,648,298	.....
Excess of exports	.....	165,202	.....	.....	.....

The U. S. Department of Commerce announces that the delays in compilation of the import and export statistics due to the greatly increased number of items required under the last tariff act have been overcome, and the import and the export figures are again issued coincidently at the usual time.

Production of Platinum and Allied Metals in 1922 Practically Unchanged

Reports of placer miners made to the Department of the Interior through James M. Hill, of the Geological Survey, show that in 1922 there was produced in the United States 968 oz. of crude platinum, which sold for $105,000. Of this quantity Alaska produced 39 oz., California 876 oz., and Oregon 53 oz. Refiners reported purchases of crude platinum as follows: Alaska, 34 oz.; California, 918; Oregon, 95; Idaho, 7; Washington, 4; a total of 1,058 oz. Purchases of foreign crude platinum in the following amounts were reported by refiners: Canada, 12 oz.; Colombia, 53,385; Russia, 10,085; a total of 63,482 oz. The total purchases of crude platinum reported by refiners, including domestic and foreign, amounted to 64,540 oz.

New Refined Platinum Metals

Reports from refiners indicate that in 1922 the quantity of new platinum metals recovered was 1 per cent greater than in 1921. There was a small increase in the quantity of platinum and osmiridium recovered, but a decrease in the quantity of palladium, iridium, and the less used platinum metals. Of the new metals recovered in 1922 about 3,373 oz., or 6 per cent, is believed to have been obtained from domestic material.

New Platinum Metals Recovered by Refiners

(In Troy Ounces)

	Platinum	Palladium	Iridium	Osmiridium	Other	Total
1918	54,399	4,024	465	539	326	59,753
1919	40,220	3,807	401	403	279	45,109
1920	36,015	4,309	418	409	393	41,544
1921	51,791	2,686	286	581	1,026	56,370
1922	54,142	1,943	210	1,301	122	57,718

Secondary Platinum

Platinum metals recovered from scrap and other old material form a large part of the supply. The total quantity thus recovered in 1922 was less than 1 per cent greater than that recovered in 1921.

Secondary Platinum Metals Recovered by Refiners

(In Troy Ounces)

	Platinum	Palladium	Iridium	Total
1918	40,378	1,795	3,410	45,583
1919	54,545	3,467	3,504	61,516
1920	51,255	3,100	3,355	57,710
1921	39,131	4,887	1,776	45,794
1922	40,062	4,193	1,937	46,192

Imports Show Increase

Refined platinum metals are imported in considerable quantity, as well as crude platinum, which is bought by domestic refiners. As is shown by the following table, the total imports increased a little over 6 per cent.

Platinum Metals Imported for Consumption in the United States, 1921-1922

	1921		1922(a)	
	Quantity (Troy Ounces)	Value	Quantity (Troy Ounces)	Value
Platinum or crude platinum and unmanufactured products, ingots, bars, sheets, wire	61,941	$4,135,235	72,410	$5,573,829
Platinum, manufactured products, vases and retorts	76	(b)28,524	366	(c)50,989
Iridium	1,345	277,597	1,129	149,555
Osmiridium	2,603	296,277	1,726	194,678
Osmium	161	13,239	743	54,896
Palladium	11,348	629,965	6,835	375,296
Rhodium	609	53,359	78	12,885
Ruthenium	152	4,268	50	2,673
	78,235	5,438,464	83,337	6,414,801

(a) Jan. 1 to Sept. 21, 1922.
(b) Includes 13 oz. wire, valued at $14,404, imported under 15 per cent duty and "all other" to the value of $6,947, quantity not given.
(c) Includes 348 oz. of wire, valued at $41,441, imported under 15 per cent duty, 18 oz. of vases, valued at $2,813, and "all other" to the value of $6,735, quantity not given.

The total consumption of platinum metals in the United States in 1922 was 181,498 troy oz., an increase of about 3 per cent as compared with the consumption in 1921.

Consumption of Platinum in the United States, 1921-1922, By Industries

(In Troy Ounces)

Industry	Platinum	Iridium	Palladium	Total	Per Cent
1921					
Chemical	12,273	34	45	12,352	7.02
Electrical	20,574	1,003	7,626	29,203	16.58
Dental	13,181	75	8,501	21,757	12.35
Jewelry	101,258	2,367	1,265	104,890	59.55
Miscellaneous	3,791	3,938	217	7,946	4.50
Total	151,077	7,417	17,654	176,148	100.00
1922					
Chemical	8,834	172	458	9,464	5.02
Electrical	24,988	1,537	2,735	29,260	16.12
Dental	11,651	83	5,535	17,269	9.71
Jewelry	108,527	2,588	9,852	120,967	66.65
Miscellaneous	2,838	1,064	636	4,538	2.50
Total	156,838	5,444	19,216	181,498	100.00

Refiners' Stocks Increase

The stocks of platinum metals in the hands of refiners at the end of 1922 were 76,017 troy oz., which represents an increase of 11,470 oz. compared with stocks at the end of 1921.

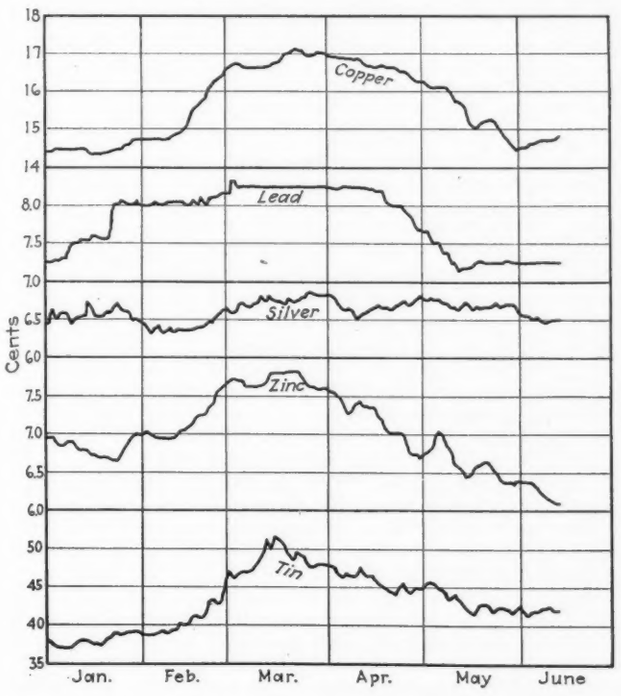
Stocks of Platinum Metals in Hands of Refiners, 1920-1922

(In Troy Ounces)

	Platinum	Iridium	Palladium	All Other
1920	46,747	4,196	16,565	.....
1921	38,514	4,991	21,042	.....
1922	41,900	7,559	24,975	1,583

Metal Price Fluctuations January-June, 1923

The chart reproduced below shows the fluctuations in price of copper, lead, "foreign" silver, zinc, and Straits tin from Jan. 1, 1923, to June 13. All prices are in cents per pound except silver, which is in cents per ounce. The price of zinc is that of the St. Louis market, but the other



prices are those at New York. The fact that silver has held its own, while other prices showed marked declines during April and May, indicates that the ending of the Pittman Act was offset by other favorable factors. The decline in the prices of copper, lead, and tin seems to have come to an end about the first of June.

Imports of Ores and Metals in April

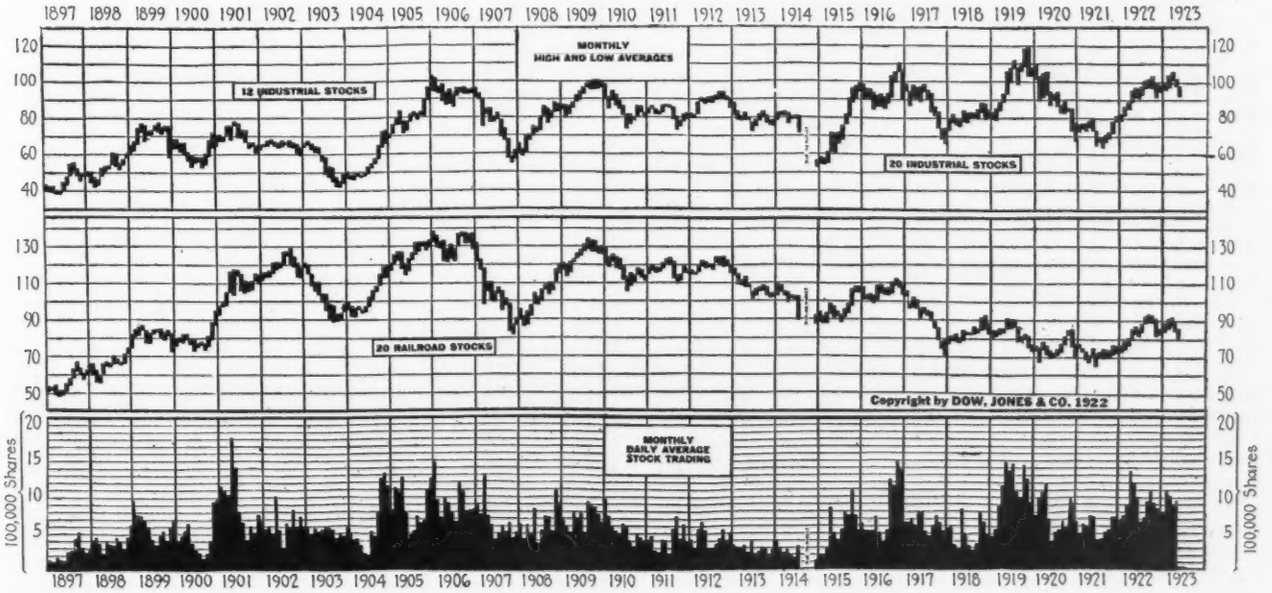
Imports of ores and metals during April, 1923, with revised comparative figures for April, 1922, compiled from the returns to the U. S. Department of Commerce, were as follows:

Imports of Ores and Metals

In Pounds, Unless Otherwise Stated

	April, 1922	April, 1923
Antimony		
Ore	.....	345,347
Metal, matte and regulus	986,465	522,805
Copper		
Ore	7,764,694	5,892,856
Concentrates	1,676,411	6,427,148
Regulus, coarse metal and cement copper	1,375,560	.....
Total	10,816,665	12,320,004
Imported from		
Spain	1,099,481	697,440
Canada	754,786	1,609,015
Mexico	870,035	6,460,940
Cuba	2,620,660	.....
Chile	5,143,377	3,470,845
Colombia	37	.....
Peru	69,492	137
Other countries	258,797	81,627
Unrefined black, blister and converter copper in pigs and bars	21,263,761	7,643,962
Imported from		
United Kingdom	8,444,033	.....
Canada	.....	4,605,538
Mexico	4,909,687	784,264
Chile	1,283,276	2,254,160
Peru	4,226,421	.....
Portuguese Africa	2,247,886	.....
Other countries	152,458	.....
Refined copper	4,512,357	15,347,584
Old and clippings for remanufacture	2,966,060	1,010,956
Composition metal, copper chief value	39,958	810,421
Copper manufactures	.....	17,083
Brass		
Old and clippings for remanufacture	7,147,689	7,786,836
Manufactures of brass	.....	49,205
Lead		
Ore and matte	1,646,019	8,900,027
Bullion or base bullion	3,602,232	8,253,032
Pigs, bars, other forms and old	170	15,463,063
Manufactures of lead (except type metal)	.....	72,896
Manganese ore, long tons	25,559	.....
Pyrites, long tons	30,480	14,680
Tin		
Tin ore, tons	1,359	1,050
Tin in bars, blocks and pigs	10,526,046	16,802,130
Imported from		
United Kingdom	1,455,991	1,404,132
British Straits Settlements	8,564,510	10,916,966
Dutch East Indies	55,971	2,199,610
Hongkong	449,574	1,580,004
Australia	.....	185,920
Other countries	.....	515,498
Tungsten ore, long tons	.....	1,212
Zinc ore (free)	.....	273,437
Zinc in blocks and pigs (dutiable)	72	4,259
Zinc dust (dutiable)	.....	1,826

The Range of Stock Prices and Volume of Sales in the Last Twenty-six Years


1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923
MONTHLY HIGH AND LOW AVERAGES
12 INDUSTRIAL STOCKS
20 INDUSTRIAL STOCKS
20 RAILROAD STOCKS
Copyright by DOW, JONES & CO. 1922
MONTHLY DAILY AVERAGE STOCK TRADING
100,000 Shares

The above chart, which we reprint from the "Wall Street Journal," shows the variations in the prices of industrial stocks and of railroad stocks, as well as the volume of sales, for the years 1897 *to* 1923 *inclusive. There is a difference of opinion as to whether the price peak of March will again be reached in the quotations of the current year.*

German Metal Buyers Cautious With Big Decline in the Mark

SPECIAL FOREIGN CORRESPONDENCE

In May, the mark depreciated another 100 per cent, a course that has since continued. As New York copper quotations declined, however, the rise in copper prices in Germany was only about 70 per cent. The exchange movements brought about an active demand on the metal exchanges and among dealers, but the genuine requirements of consumers remain on a modest scale. The productivity of the metal trades generally has declined by 40 per cent since the occupation of the Ruhr. The business boom at present is chiefly a dealers' boom. The Federal Railways, which have in the past taken enough metal to support the market, are in a bad financial plight, and the grand electrification schemes will have to be left until normal conditions warrant them. Nevertheless a certain revival of metal business incidental to the mark slump may be inferred by the fact that the amount of copper ordered in America and London in May is computed to exceed that of April by about 2,000 metric tons.

ALUMINUM SUPPLIES SHORT

The enlargement of the inquiry is to be ascribed mainly to two facts: first, the unexampled shortness of aluminum, which had become an important substitute for copper, and a shortness of other metals for alloys. Much propaganda had been published for the entire substitution of copper by aluminum for electric transmission purposes, but the lighter metal has now been sold out up to November by the Vereinigte Aluminiumwerke of Lauta; and the so-called Erftwerk, which is situated in the Rhineland province, cannot sell to Eastern Germany for well-known reasons. The rolling mills have long-term contracts for export. The already narrowed output of virgin aluminum in Germany is therefore all contracted for and the available balance for German users is negligible.

The second factor in the increased inquiry is the removal of export duties which heretofore tended to make German metal products dearer, and even above the world level.

The general feature of the metal market is the cautious attitude of buyers all around. The usual speculative dealings in bullion, especially in silver, are now forbidden by law. This legislation has so far only favored the big firms who can rely on refineries and finishing mills of their own.

The firm of Aron Hirsch, of Halberstadt, that co-operated with the Hirsch Kupfer und Messingwerke, has combined its financial forces with that of the Metallgesellschaft with respect to settling ore contracts of a long-term nature, and in purchasing copper from American producers outside of the Copper Export Association, such as the Lewisohn group. The Berlin branch of the Copper Export Association, which sells to all of central Europe, has had an uphill fight against the cheap quotations of those American and British holders who became timorous and offered the metal at a half or three-quarters of a cent below the "official" quotation. At last the Association gave way and adjusted its price policy to that of its competitors.

REQUIREMENTS OF OTHER COUNTRIES ARE SMALL

The Italian railways are to be sold soon by the government to private owners, and so are taking no metal for repairs and improvements, in order to decrease unnecessary debts of the government. Ammunition orders of foreign countries to Switzerland have ceased altogether. Czechoslovakia has suffered a setback on account of the Ruhr disturbance, and Austria and Hungary, normally good metal consumers, are only slowly recovering, taking about an eighth of their normal requirements. So Germany, even under present conditions, plays a comparatively important part as a metal consumer.

Since the decrease in the Eastern Upper Silesian zinc supplies, and the locking up of the sources of the Stolberger Aktiengesellschaft für Zinkfabrikation, German users are seeking American metal, the abundant Belgian zinc output finding no favor among German galvanizers, on account of political sentiment.

Facts for the Stockholder

XX—Miami Copper Co.

THE MIAMI COPPER CO. was incorporated in Delaware, November, 1907. It is controlled through stock ownership by the General Development Co., incorporated in January, 1906. The operating company owns 2,273 acres of land, of which 274 acres are mineral, the remainder being valuable for water rights, buildings, and tailing storage, in the Miami district, about six miles west of Globe, Arizona.

The orebodies are in altered schist, fractured and fissured, and in contact with intrusive granite. There are two principal orebodies, the Main and the Captain. The former is about 1,000 ft. long by 750 ft. wide, and the latter is about 500 ft. square. Formerly the ore was mined by top slicing, but in 1919 the undercut caving system was adopted. On January 1, 1923, ore reserves were estimated at 6,756,187 tons of high-grade sulphide ore averaging 2.26 per cent copper, 6,000,000 tons of mixed sulphide and oxide ore averaging 2 per cent copper, and 36,000,000 tons of low-grade sulphide ore averaging 1.06 per cent copper.

The mine is opened by several shafts and extensive underground workings, also a great deal of diamond drilling, all of which has disclosed payable ore to a depth of over 835 ft. Development openings have been extended at rates varying from 15,000 to 40,000 ft. per annum.

The main operating shaft, No. 5, has four compartments, two for hoisting, one for handling men and material, and one for ladderways and pipes. It is equipped with a 2,000 hp. electric double-drum ore hoist, with a capacity of 15,000 tons a day. This shaft is 936 ft. deep.

The crusher plant has a capacity of 15,000 tons a day, and the electrically driven concentrator consists of six sections, and has a capacity of about 7,500 tons a day. The pumping plant, electrically driven, is at Burch, four miles distant. Power-house equipment includes boiler plant with 4,750 b.hp. capacity, using oil fuel; power house with two 4,000 kw. turbo-generators; three 1,000 kw. four-cylinder, triple-expansion generators, and two 4,000 cu.ft. triple-expansion, two-stage air compressors, condensers, with other complementary apparatus. There is a complete layout of warehouses, office building, and dwellings.

Production in recent years, in millions of pounds of copper, has been as follows: 15.4 in 1911, 32.8 in 1912, 32.9 in 1913, 33.3 in 1914, 41.8 in 1915, 53.5 in 1916, 43.8 in 1917, 58.4 in 1918, 54.2 in 1919, 55.6 in 1920, 53.3 in 1921, and 67.4 in 1922.

Costs per pound of copper including depreciation (except 1911) during the last several years are estimated as follows: 9.10c. in 1911, 10.10c. in 1912, 11.27c. in 1913, 9.60c. in 1914, 9.18c. in 1915, 9.97c. in 1916, 13.16c. in 1917, 15.81c. in 1918, 16.35c. in 1919, 12.40c. in 1920, 11.91c. in 1921, and 10.33c. in 1922. The cost of mining 2,183,020 tons of ore in 1922, averaging 1.883 per cent copper, was $1.113 a ton; milling $0.644; and general mine expense $0.299; making the cost at smelter $2.057 a ton. Average price obtained for the copper sold during 1922 was 13.50c. a pound. Operations were at approximately 80 per cent capacity.

Capital stock consists of 747,114 shares, par value $5. There is no funded debt. In January, 1922, the company had 13,000 stockholders, compared with 10,000 in April, 1921.

Earnings per share after depreciation (except 1911) have been as follows: $0.74 in 1911, $2.81 in 1912, $1.74 in 1913, $1.65 in 1914, $4.56 in 1915, $10.39 in 1916, $6.63 in 1917, $7.04 in 1918, $2 in 1919, $3.86 in 1920, $1.24 in 1921, and $2.64 in 1922.

The dividend record is as follows: $1.50 a share in 1912, $2 in 1913, $1.50 in 1914, $2.25 in $1915, $5.75 in 1916, $8.75 in 1917, $4.50 in 1918, $2.50 in 1919, $2 in 1920, $2 in 1921, and $2 in 1922. The present rate is $2 a share per annum, payable quarterly.

On Dec. 31, 1922, current assets were about $8,000,000, against current liabilities of $1,600,000, with net working capital over $6,450,000. Net tangible assets applicable to capital stock amounted to about $28 a share, compared to $31 for the year preceding.

Price range of the stock has been: High, 49⅛ in 1916; low, 14⅛ in 1920; closing price 24 on June 19, 1923.

INVESTIGATOR.

MINING STOCKS

Week Ended June 16, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	68	66½	66½	June 23, Q	$1.50
Alaska-Br. Col.	N. Y. Curb	2¼	2⅛	2¼		
Allouez	Boston	23	19½	19½	Mar. '19	1.00
Anaconda	New York	46	44	44½	Apr. '23, Q	0.75
Arcadian Consol.	Boston	1⅛	1⅛	1⅛		
Ariz. Com'l.	Boston	11½	9⅞	10¼	Oct. '18, Q	0.50
Calaveras	N. Y. Curb	2	2	2		
Calumet & Arizona	Boston	52	50¼	51	Mar. '23,	1.00
Calumet & Hecla	Boston	385	370	380	June '23, Q	10.00
Centennial	Boston	9⅛	9⅛	9⅛	Dec. '18, SA	1.00
Cerro de Pasco	New York	43¼	42½	42½	May '23,	1.00
Chile Copper	New York	27⅛	26½	26½	Mar. 23,	0.62½
Chino	New York	23½	21¼	22	Sept. '20, Q	0.37½
Con. Coppermines	N. Y. Curb	3¼	3	3		
Copper Range	Boston	33¾	32½	32¼	May '23, Q	1.00
Crystal Copper	Boston Curb	1 1/16	1 1/16	1 1/16		
Davis-Daly	Boston	3¼	3¼	3¼	Mar. '20, Q	0.25
East Butte	Boston	7½	7	7	Dec. '19, A	0.50
First National	Boston Curb	43	42	43	Feb. '19, SA	0.15
Franklin	Boston	*50	*40	*40		
Gadsden Copper	N. Y. Curb			*80		
Granby Consol.	New York	24¼	23	23½	May '19, Q	1.25
Greene-Cananea	New York	23	23	23	Nov. '20, Q	0.50
Hancock	Boston	2⅜	1⅞	1⅞		
Howe Sound	N. Y. Curb	3¼	3¼	3¼	Jan. '21, Q	0.05
Inspiration Consol.	New York	33½	31⅞	31½	Apr. '23, Q	0.50
Iron Cap	Boston Curb	5⅜	5¼	5⅜	May 23, K	0.15
Isle Royale	Boston	23	22	22	Mar. '23, Q	0.50
Kennecott	New York	37	35⅛	36	Apr. '23, Q	0.75
Keweenaw	Boston	1	1	1		
Lake Copper	Boston	2½	2½	2½		
Magma Copper	New York	33	30½	30½	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1¼	1¼	1¼		
Mass Consolidated	Boston	1⅞	1⅞	1⅞	Nov. '17, Q	1.00
Miami Copper	New York	26	25½	25½	May '23, Q	0.50
Michigan	Boston	1⅛	1⅛	1⅛		
Mohawk	Boston	51½	50½	50½	June '23, Q	1.00
Mother Lode Con.	New York	9⅛	9⅛	9⅛	Mar. '23, K	0.50
Nevada Consol.	New York	15⅛	13¼	13⅛	Sept. '20, Q	0.25
New Cornelia	Boston	18½	17⅛	18	May '23, Q	0.25
North Butte	Boston	8	4	5½	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*67	*57	*61		
Old Dominion	Boston	22½	22	22	Dec. '18, Q	1.00
Osceola	Boston	33½	33	33	Mar. '23, K	1.00
Phelps Dodge	Open Mar.	†165	†175		Apr. '23, Q	1.00
Quincy	Boston	32	30½	30½	Mar. '20, Q	1.00
Ray Consolidated	New York	13	12½	12⅝	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅛	1⅛	1⅛		
St Mary's Min. Ld.	Boston	38	37½	37½	Mar. '23, K	3.00
Seneca Copper	New York	8⅛	7⅛	7⅛		
Shannon	Boston	*75	*60	*70	Nov. '17, Q	0.25
Shattuck Arizona	New York	7	7	7	Jan. '20, Q	0.25
South Lake	Boston			*12		
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C. cfs.	New York	10⅛	9⅛	9⅛	Apr. '23, Q	0.25
Tuolumne	Boston	*30	*22	*22	May '13,	0.10
United Verde Ex.	N. Y. Curb	35½	34½	35	May '23, Q	1.00
Utah Consol.	Boston	1⅜	1⅜	1⅜	Sept. '18,	0.25
Utah Copper	New York	65⅛	64	65⅛	Mar. '23, Q	1.00
Utah Metal & T.	Boston	*84	*75	*78	Dec. '17,	0.30
Victoria	Boston	1	1	1		
Winona	Boston	*90	*76	*90		
Wolverine	Boston	8	7⅛	7⅛		
NICKEL-COPPER						
Internat. Nickel	New York	15	13⅜	14⅛	Mar. '19,	0.50
Internat. Nickel pfd.	New York	83	82¼	82½	May '23, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh			3⅜		
National Lead	New York	122	118	118	Mar. '23, Q	2.00
National Lead pfd.	New York			111½	June '23, Q	1.75
St. Joseph Lead	New York	19⅛	19⅛	19⅛	Mar. '23, Q, X	0.50
ZINC						
Am. Z. L. & S.	New York	12⅜	9	9⅜	May '20,	1.00
Am. Z. L. & S. pfd.	New York	43	40	41	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅜	6⅜	6⅜	Mar. '23,	0.50
Butte & Superior	New York	24¼	22⅜	22⅜	Mar. '23, Q	0.50
Callahan Zn-Ld.	New York	7	6½	6½	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	158	153	153	May '23, Q	2.00
United Zinc	N. Y. Curb					
Yellow Pine	Los Angeles	*62½	*56½	*56½	Sept. '20, Q	0.03
SILVER						
Alvarado	N. Y. Curb	4	4	4		
Batopilas Mining	New York	½	½	½	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*35	*34	*35	May '20, K	0.03
Candelaria	N. Y. Curb	*8	*6	*7		
Castle-Trethewey	Toronto	*25	*24½	*25		
Coniagas	Toronto	2.80	2.70	2.70	May '21, Q	0.12½
Crown Reserve	Toronto	*63	*57½	*62½	Jan. '17,	0.05
Hilltop-Nev.	N. Y. Curb.	1½	*75	*95		
Kerr Lake	N. Y. Curb	2⅜	2¼	2¼	Apr. '23, Q	0.12½
La Rose	Toronto	*35	*33	*33	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*19½	*17½	*19½	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	2.75	2.70	2.70	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5⅛	5⅛	5⅛	Apr. '23, Q	0.15
Ontario Silver	New York	5¼	5¼	5¼	Jan. '19, Q	0.50
Temiskaming	Toronto	*43	*42½	*42½	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅛	1	1⅛		
Boundary Red M.	N. Y. Curb			*20		
Carson Hill	Boston	6⅛	5⅛	6⅛		
Cresson Consol. G.	N. Y. Curb	3⅛	3⅛	3 1/16	Apr. '23 Q	0.10
Dome Mines	New York	38⅛	36¼	37⅛	Apr. '23, Q	0.50
Golden Cycle	Colo. Springs	1.08	1.08	1.08	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	13.60	12.95	13.00	une '23, M	0.05
Homestake Mining	New York	65	65	65	May '23, M	0.50
Kirkland Lake	Toronto	*40	*39½	*39½		
Lake Shore	Toronto	3.55	3.50	3.50	May '23, Q	0.02
McIntyre-Porcupine	New York	19½	18	18⅛	May '23, Q	0.25
Portland	Colo. Springs			*37½	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1⅛	1 1/16	1 1/16		
Tom Reed	Los Angeles	*66½	*62	*62	Dec. '19,	0.02
United Eastern	N. Y. Curb	2	1⅛	1 1/16	Apr. '23, Q	0.15
Vipond Cons.	Toronto	*52	*48	*48		
White Caps Mining	N. Y. Curb			*5		
Wright-Hargreaves	Toronto	3.35	3.30	3.30	Apr. '23,	0.02½
Yukon Gold	N. Y. Curb	1⅛	1⅛	1⅛	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*19	*13	*16		
Con. Cortez	N. Y. Curb	65	67	67		
Cons. Virginia	San Francisco	11¼	9½	10⅛		
Continental Mines	N. Y. Curb	5⅛	5	5⅛		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅛	Apr. '23	0.05
Jib Consol.	N. Y. Curb	*85	*85	*85		
Tonopah Belmont	N. Y. Curb	*82	*73	*80	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*63	*48	*53	May 23	0.10
Tonopah Extension	N. Y. Curb	1 1/16	1 1/16	1 1/16	Jan. '23, Q, X	0.10
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1⅛	Apr. '23, Q	0.07½
Unity Gold	N. Y. Curb	4⅛	4⅛	4⅛		
West End Consol.	N. Y. Curb	*97	*94	*94	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston			16⅛	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake	*56	*55	*55	Dec. '20,	0.15
Chief Consol.	Boston Curb	4⅛	3⅞	3⅞	May '23, Q	0.10
Columbus Rexall	Salt Lake	*66	*57	*63	Aug. '22,	0.03
Consol. M. & S.	Montreal	27½	25½	27½	Oct. '20, Q	0.62½
Federal M. & S.	New York	7	7	7	Jan. '09,	1.50
Federal M. & S. pfd.	New York	40½	39½	39½	Mar '23, Q	1.75
Florence Silver	Spokane	*38	*38	*38	Apr. '19, Q, X	0.01½
Hecla Mining	N. Y. Curb	8	7⅞	8	Mar. '23,	0.25
Iron Blossom Con.	N. Y. Curb	*28	*26	*26	Apr. '22, Q	0.02½
Marsh Mines	N. Y. Curb	*13	*13	*13	June '21, I	0.02
Park City	Salt Lake			3.15	Apr. '23,	0.12½
Park Utah	N. Y. Curb			3⅛	Apr. '23	0.15
Prince Consol.	Salt Lake	*4½	*4	*4	Nov. '17,	0.02½
Silversmith	Spokane	*41½	*40	*40	Apr. 23,	0.01
Simon Silver Lead	N. Y. Curb	*35	*30	*32		
Snowstorm Silver-L.	N. Y. Curb	*43	*40	*43		
Tamarack-Custer	Spokane	1.32	1.25	1.25	Jan. '21, K	0.04
Tintic Standard	Salt Lake	3.20	3.17½	3.17½	Dec. '22, Q, X	0.10
Utah-Apex	Boston	4	3⅞	3⅞	June '23, Q, X	0.50
IRON						
Bethlehem Steel	New York	53⅜	49⅜	51⅛	Apr. '23, Q	1.25
Char. Iron	Detroit			1		
Char. Iron, pfd	Detroit			2⅛		
Colorado Fuel & Iron	New York	34	31½	31½	May '23, Q	2.00
Col. Fuel & Iron pfd.	New York			102	Feb '23, Q	2.00
Gt. North'n Iron Ore	New York	29	28½	28⅝	Apr. '23	1.00
Inland Steel	N. Y. Curb			46½	June '23 Q	0.62½
Mesabi Iron	N. Y. Curb			9		
Replogle Steel	New York	19	16⅜	17⅛		
Republic I. & S.	New York	51½	48½	49	May '23	1.50
Republic I. S. pfd.	New York	95½	94⅜	94⅞	Apr. '23	1.75
Sloss-Sheffield S. & I.	New York	49½	48	48	Feb. '21	1.50
Sloss-Shef. S. & I. pfd.	New York			80	Apr. '23	1.75
U. S. Steel	New York	96⅜	93⅜	94½	Mar. '23, Q	1.25
U. S. Steel pfd.	New York	119⅜	118	119½	May '23	1.75
Virginia I. C. & C.	New York	59	55	55	Jan. '22	1.50
Virginia I.C.&C.pfd.	New York	80½	80½	80½	Jan '23	2.50
VANADIUM						
Vanadium Corp.	New York	33½	31½	31½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	62½	55	55½	Apr. '23 Q	1.50
Asbestos Corp. pfd.	Montreal	79	78½	78½	Apr. '23 Q	1.75
SULPHUR						
Freeport Texas	New York	14	12½	13	Nov. '19, Q	1.00
Texas Gulf	New York	60½	58½	58½	May '23, Q	1.50
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3	3	3		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	46	46	46	Mar. '23, Q	0.75
Amer. Metal pfd.	New York			114	Mar. '23, Q	1.75
Amer. Sm. & Ref.	New York	63⅛	61½	62	Mar. '21, Q	1.00
Amer. Sm. & Ref. pfd	New York	97⅞	96½	96½	Mar. '23 Q	1.75
U. S. Sm R. & M.	New York	29½	27	27	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	44½	44	44	Apr. '23 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

INDUSTRIAL NOTES

Chemical Exposition Plans Buying Fair

Plans are being considered for making the next Exposition of Chemical Industries, to be held at the Grand Central Palace, New York, Sept. 17-22, a "chemical buying fair." At a meeting of the advisory committee at the Chemists' Club on June 6 it was suggested that each exhibitor make every effort to display his goods in a novel method and in a manner which to some degree, at least, will demonstrate their particular characteristics, special uses, and selling points. It was also suggested that all exhibitors arrange to have their full sales forces, or as many as it might be feasible, at the exposition, so that they might not only attend company sales conferences in conjunction with the exposition, but also attend joint sales conferences composed of the sales staffs of all the exhibitors. With the large number of chemical and chemical equipment consumers who attend the exposition each year, this sales contact on a large scale, away from the offices of the buyers, was pointed out as very desirable.

The Porcupine Peninsular Gold Mines, Ltd., Connaught, Ont., has bought an 8 ft. x 36-in. Hardinge ball mill for its new plant. A 3 ft. x 8-in. ball mill has likewise been purchased by the New Riverside Ochre Co., Cartersville, Ga., also a 6 ft. x 22-in. ball mill for the new plant of the Bluster-Consolidated Gold & Silver Mines Co., Jarbidge, Nev. The Mohawk Mining Co., Gay, Mich., has purchased four 7-ft. x 36-in. Hardinge ball mills for regrinding in its concentrator.

The name of the Electric Steel Co., Chicago, was changed to Nugent Steel Castings Co. at a stockholders' meeting held in Chicago, May 28. There is no change of management, ownership, or personnel. Charles Piez is president of the company, W. J. Nugent vice-president and general manager, Prentiss L. Coonley treasurer, and C. A. MacDonald secretary. The company began operations in its present plant in 1915 and was one of the first foundries to use electric furnaces on a large scale in the production of steel castings.

The Electric Steel Founders' Research Group held a regular meeting of executives of the five electric steel foundries conducting co-operative research work, at Wernersville, Pa., a short time ago. The various phases of the research work being done by the members of the group to improve the quality of steel castings and increase efficiency in methods were discussed in detail. Formal reports giving the status of the present research investigations were read on such subjects as facing sand mixtures, core sand mixtures, electric furnace practice, heat treatment of steel castings, production control and porosity in castings. Plans were made for conducting research investigations on additional steel foundry problems.

The Montana Power Co. has awarded a contract to the Pelton Water Wheel Co. for furnishing two 7,500-hp. single-runner, single-nozzle impulse turbines for the first unit of its Mystic Lake, Mont., development. These turbines will operate under an average effective head of 1,050 ft. and will embody various distinctive Pelton features, such as auxiliary relief needle nozzles and direct-motion governors. The contract includes two hydraulic-cylinder operated gate-valves at the power house and a butterfly valve at the head of the penstock. The latter will be equipped for electric motor and hand operation and for direct and remote control.

The Guanajuato Power & Electric Co. is reconstructing one of the two main units in its Platanal plant, near Zamora, Michoacan, Mexico. This plant was built in 1903 and comprises two double-overhung Pelton impulse turbines, each driving a 1,250-kw. generator. The old wheels are still in good condition, but are of a design that is now obsolete, and the efficiency is materially lower than can be obtained with modern equipment. The demand for power on the territory served is increasing, and the officers of the company have had to choose between developing power at some other site, several being available, and increasing the efficiency and therefore the output of the present equipment. The latter course was chosen because of the saving in both expense and time. For the present only one of the two main units is to be reconstructed.

To provide more adequate facilities for its increasing volume of business in the Pittsburgh district, the Pennsylvania Crusher Co. has moved from the Peoples Bank Building to the Oliver Building, where operations will be continued under H. M. Hallett, as district manager.

The Penberthy Injector Co., of Detroit, Mich., has prepared a data sheet entitled "How to Select the Right Ejector," which may be obtained on request.

The Los Angeles representative of the Dings Magnetic Separator Co. relates this story. It gives an idea of the mystery that modern machinery and methods holds for some of the less educated mine workers:

Near Los Angeles there is a concern that buys up carcasses of animals for conversion into fertilizer. Dead bodies are first cut up into fairly large pieces, and are then ground into fine bits. A belt conveyor carries the larger sections to the grinder, and it was near this conveyor that an old darky was working just at quitting time. The conveyor has a magnetic pulley installed as the head pulley. Just as the conveyor was about to stop, a horse's leg approached the pulley. On the hoof was an iron horseshoe. As the leg reached the pulley the belt stopped. The pulley was still energized and of course the horseshoe was attracted to it, causing the leg to stand upright. The old darky worker had watched the belt slow down and stop. When the leg suddenly sprang into the air the old boy dropped his shovel, gave a yell and a leap, and ran. He may be running yet, as he's never reported—not even for his pay.

R. Stanley Webber, of Ironwood, Mich., Ingersoll-Rand sales manager for small tools in the Lake Superior district, is going to Lima, Peru, as manager of the Ingersoll-Rand branch serving the entire west coast of South America.

The Washington Water Power Co., which recently acquired the property of the Okanogan Valley Power Co., has awarded a contract to the Pelton Water Wheel Co., for furnishing a 2,500 hp. double-runner cylindrical-case reaction turbine, to operate under an 80-ft. head. This unit will be installed at the Similkameen River plant of the power company at Oroville, Wash. It will resemble in general design the Pelton turbine of the same capacity now operating at the plant, which was built for Okanogan Valley Power Co. in 1919.

Parker M. Robinson, formerly turbine engineer on the Pacific Coast for the Westinghouse Electric & Manufacturing Co., has recently joined the Hunt, Mirk & Co., 141 Second St., San Francisco, entering the firm as a junior partner. Hunt, Mirk & Co. are consulting and contracting engineers specializing in steam power plants on the western coast.

TRADE CATALOGS

Trolleys—A trolley folder has just been issued covering the new Yale trolleys. It is the first piece of literature to be issued on this equipment, and contains, in addition to detailed descriptions of the plain and geared types of the new Yale steel-plate roller-bearing trolleys, a description of the new Yale cast-iron trolley. Incorporated in it are the details of tests to which the new steel-plate trolley was subjected, and a complete list of the material-handling equipment manufactured by the Yale & Towne Manufacturing Co.

Ore Roasting Furnace—In response to a continued demand for a catalog covering the Wedge mechanical furnace, the Wedge furnace department of the Bethlehem Foundry & Machine Co., Bethlehem, Pa., has issued a 35-page catalog, No. F-1, Section 1, describing this well-known metallurgical equipment. The catalog is well illustrated, and in addition to giving details as to action and construction as well as data showing the range of sizes and cost of erection, includes other information on the development of roasting, classification of roasts, and kindred matter. The company lays stress on the fact that the Wedge is solely an ore-roasting furnace.